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The independent Dragon magazine

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How to submit articles

The quality of the material we can publish in *Dragon User* each month will, to a very great extent depend on the quality of the discoveries that you can make with your Dragon. The Dragon computer was launched on to the market with a powerful version of Basic, but with very poor documentation.

Articles which are submitted to *Dragon User* for publication should not be more than 3000 words long. All submissions should be typed. Please leave wide margins and a double space between each line. Programs should, whenever possible, be computer printed on plain white paper and be accompanied by a tape of the program.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

Contents



Editorial

When the Dragon was first launched, one of the most common queries was nothing to do with the operating system or machine code, it had to do with the whereabouts of the mushroom in Madness and the Minotaur.

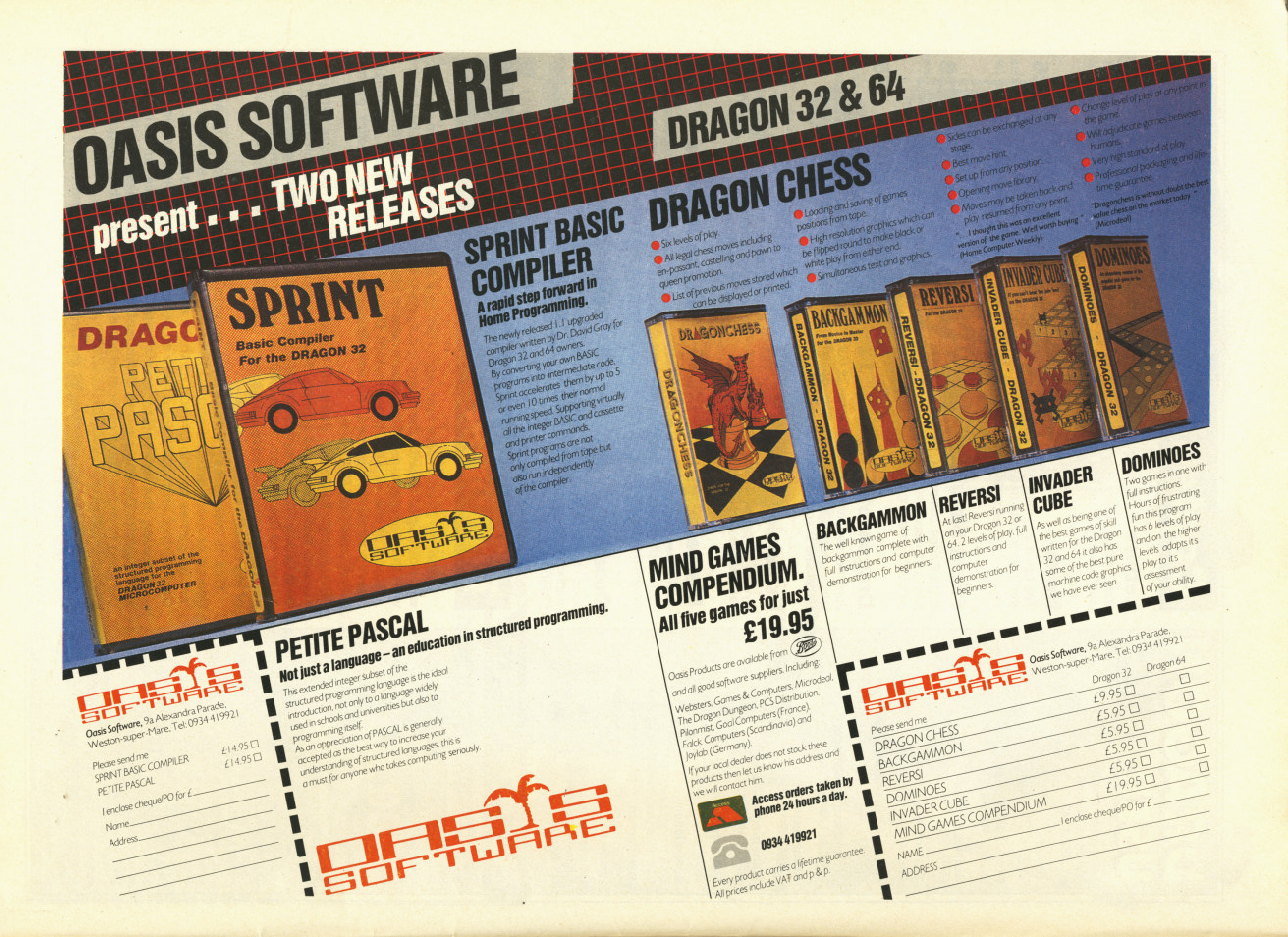
Some of the earliest independent Dragon software houses were also heavily adventure biased, notably Salamander Software, creator of the inscrutable Dan Diamond.

FOR SOME REASON there is a remarkable affinity between Dragon owners and adventure games. Many of the recent game releases have been adventure orientated. Incentive has recently converted its Ket Trilogy to the Dragon, while both Adventure International and Channel 8 have also released adventures. Now Compusense has launched a version of the classic Colossal Cave.

This is not to say that Dragon owners are not interested in arcade games or more serious applications. There are as many standard shoot 'em up games for the Dragon as there are for most micros. Manic Miner, Grid Runner and Lazer Zone have all been converted to the Dragon.

However, the adventure market still seems to have an irresistible attraction for Dragon owners. Wintersoft's Ring of Darkness and Return of the Ring have built up a dedicated band of followers, as has Dragon Data's El Diablero.

Given the depressed state of the Dragon market generally, it is nice to know that there are some areas which are still relatively buoyant. Happy adventuring!



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REVERSI - DRAGON 32
INVADER CUBE - DRAGON 32
DOMINOES - DRAGON 32
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Letters

This is the chance to air your views — send your tips, compliments and complaints to Letters Page, *Dragon User*, 12-13 Little Newport Street, London WC2H 7PP.

Load, store and retrieve

HAVING STRUGGLED long and hard with Dragondos random access data files perhaps readers would be interested in the two accompanying programs that, when run, load, store and retrieve an array up to three dimensions in a For/Next loop.

A Stein
48 Suffolk Road
Seven Kings
Ilford
Essex

```
10 'TWO PROGRAMES TO LOAD,STORE,& RETRIEVE ARRAYS
20 'NO DIMENSION CAN BE LARGER THAN 10
30 '& THERE CANNOT BE MORE THAN 3 DIMENSIONS
40 'IF THEY WERE THE STORE PROGRAM WOULD ACCEPT
50 'THEM BUT THE RETRIEVE PROGRAM WOULD NOT
60 'STORE PROGRAM
70 CLS
80 DIM X(4,5,6)                          '[FOR EXAMPLE]
90 CREATE"DATAFILE",130              '[ie 4*5*6+10BYTES]
100 FOR A=1 TO 4
110 FOR B=1 TO 5
120 FOR C=1 TO 6
130 INPUT X(A,B,C)  '[TO LOAD WITH A FOR/NEXT LOOP]
140 BL=10:BP=BL+BP'[BL=BYTE LENGTH-BP=BYTE POSTION]
150 FWRITE"DATAFILE",FROM BP,FOR BL;X(A,B,C)
160 NEXT C
170 NEXT B
190 NEXT A
```

```
10 'PROGRAM TO RETRIEVE DATAFILE
20 CLS
30 PRINT
40 INPUT"A NAME";A
50 INPUT"B NAME";B
60 INPUT"C NAME",C
70 BP=(((A-1)*30)+((B-1)*6)+C)*10
80 'EXPLANATION OF VARIABLE BP ABOVE
90 'ALL THE DIMs EXCEPT THE ONE ON EXTREME RIGHT
100 'ARE ALWAYS -1
110 'THE MULTIPLES STARTING AT THE LEFT ARE ALWAYS
120 'THE DIMS ON THE RIGHT MUTIPLIED TOGETHER, ie
130 'IN THIS CASE A=5*6 & B=6 AS ONLY 1 DIM REMAINS
140 'TWO DIM ARRAYS ARE DONE THE SAME WAY
150 '& AN EXAMPLE OF X(B,C)=X(5,6) WOULD BE
160 'BP=(((B-1)*6)+C)*10
170 'ONE DIM ARRAYS WOULD SIMPLY HAVE BP=SIZE
180 'OF ARRAY,ie,X(C) WOULD SIMPLY BE BP=C*10
190 FREAD"DATAFILE",FROM BP,FOR 10;X(A,B,C)
200 PRINT"ANSWER";X(A,B,C)
210 GOTO 30
```

Infinite lives poke?

I HAVE recently purchased a game called *Manic Miner*. Is it possible to obtain a code to enable me to have as many lives and screens as possible, as one can on the Commodore 64 and Spectrum?

Robert Williams
12 Esplen Avenue
Crosby
Liverpool L23 2SS

A change of mode

I AM putting together a very simple program on the Dragon 32 which will enable me to produce letters, reports and such like via a printer.

One problem I have at the moment is figuring out how I might be able to get out of the lower-case text mode by using a poke from within the program, rather than the "SHIFT+@" from the keyboard. Can you tell me whether this is possible and how I might do it?

By the way, you may be interested to know that Iolo ap Gwynn's machine code screen-dump program in the September 1984 issue works perfectly on the Mannesmann Tally "SPIRIT-80" printer too, and has proved very useful to me!

John Harrington
8 West View
Northgate
Morpeth
Northumberland NE61 3BT

Back issues on demand

DURING THE past month I have been abroad and, as a consequence, missed the December issue of *Dragon User*. My local newsagent has already sent back his unsold copies. Is there any way I could purchase this issue, either from the publishers or some 'back issue' company?

G White
202 Cutenhoe Road
Luton
Beds LU1 3NJ

Back issues of the magazine are available direct from us. Simply send £1.25 per copy to *Dragon User*, Back Issues, 12-13 Little Newport Street, London WC2H 7PP.

Simple solution

WITH REFERENCE to R Hadekel's letter in *Dragon User* September there is a simple solution to his problem. This is to use the PCLEAR subroutine located in ROM, avoiding the check for PCLEAR 0.

If the following line is added to the beginning of a program, it will cause the removal of all high-res pages with the loss of variables, but not the program (ie as with the normal PCLEAR). But, beware, high-res commands are not disabled and, if they are used, the basic program will very likely be corrupted:

A$=CHR$(&H96)+CHR$(&HBC)+CHR$(&HC6)+CHR$(&H01)+CHR$(&H1F)+CHR$(&H02)+CHR$(&H7E)+CHR$(&HAA)+CHR$) (&H35):A=VARPTR (A$):A=PEEK (A+2)★256+PEEK(A=3):EXEC A

F Carlotti
Hope Point House
Kingsdown
Deal
Kent

Mystery functions

DRAGON DATA is not the only culprit in failing to provide complete documentation in computer software manuals. Other users of 6809 based machines and Microsoft Basic seem to find omissions and errors on a regular basis. I'd like to pass on a recent "find" by Alan Farmer, as reported in the Reader's Forum of the September 1984 issue of *Hot CoCo*. The "Mystery Functions in the EDIT Command" that he found in his TRS-80 colour computer work perfectly well in the Dragon.

Three single key functions are described: A, Q, and E, used while the computer is in edit mode. A is particularly helpful to hackers like myself who manage to mess up the corrections while in EDIT, and then wish that they could erase the "corrections" and start over without leaving EDIT. A single stroke on the A key does just that.

Q is for the person who realises that he is editing the wrong line, or that the original was really correct. Q not only erases the editing, but also exits the EDIT mode.

E allows you to exit the EDIT mode immediately without displaying the balance of the edited line. A minor time-saver. One important item that wasn't mentioned, if you are in Insert mode within EDIT, then the letters A, Q, and E are simply inserted into the program line you are editing.

Harry C Taylor II
Kiriat-Ono
Israel

Software Top 10

1	(5)	**Manic Miner**	Software Projects
2	(–)	**Mystery of the Java Star**	Shards
3	(1)	**Hunchback**	Ocean
4	(3)	**Dragon Chess**	Oasis
5	(2)	**Chuckie Egg**	A & F
6	(7)	**Sprite Magic**	Knight Software
7	(10)	**Bug Diver**	Mastertronic
8	(–)	**Cuthbert goes Walkabout**	Microdeal
9	(–)	**Ring of Darkness**	Wintersoft
10	(–)	**Database**	MST

Chart compiled by Websters Software

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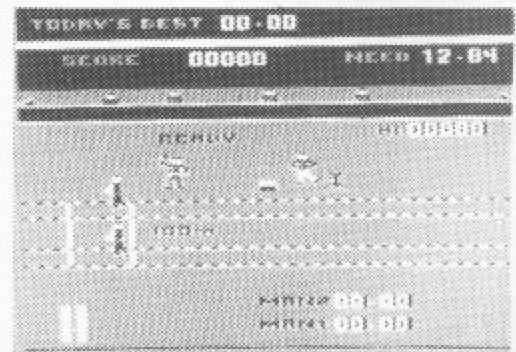
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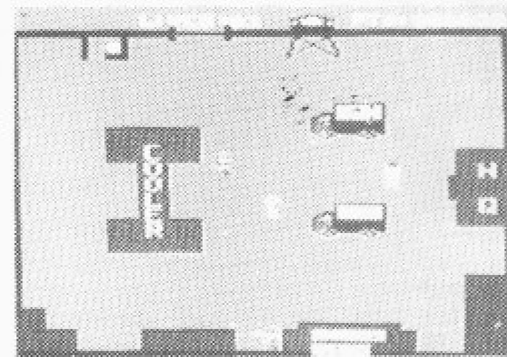
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Cuthbert in the Cooler



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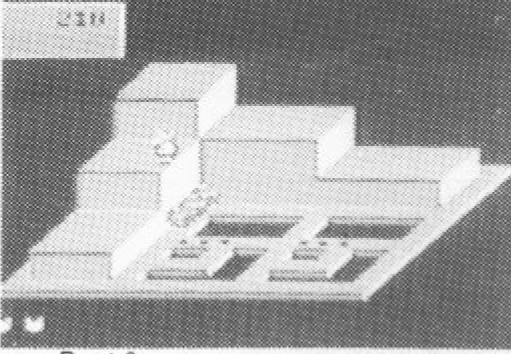
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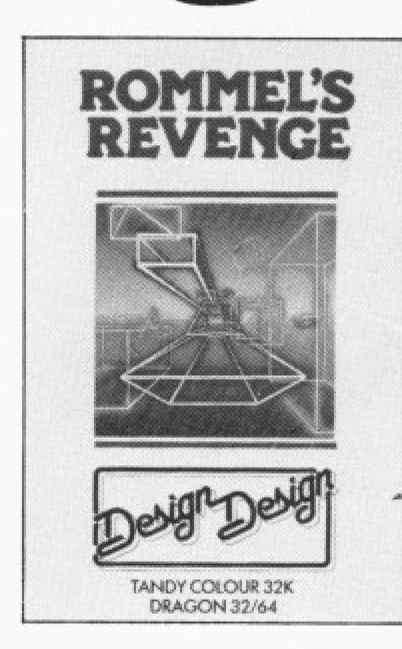
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Revenge

ROMMEL'S REVENGE is a new game from Design Design for both Dragon and Tandy owners. Originally written for the Spectrum, *Rommel's Revenge* is a version of the *Battlezone* arcade game.

The game, which costs £7.95, features 3D graphics with full perspective.

The object of the game, which is set on a futuristic battlefield, is to destroy the enemy tanks ploughing relentlessly towards you. The enemy tanks are remote controlled and come in two types, standard and super deadly. Both types are controlled by mobile fire control saucers which hover low over the battlefield.



You can avoid enemy shells by using the blocks and pyramids scattered around the battlefield as cover. But, your only defence against an air-launched anti-tank missile is to destroy it before it destroys you.

The game, which is joystick compatible, is available from Tandy dealers or direct from Design Design, 2 Ashton Way, East Herrington, Sunderland SR3 3RX.

Bulletin Board

BRIAN LLOYD, author of Sunshine's *Dragon Trainer,* is setting up a bulletin board for Dragon owners. It will run on a Dragon 64 with twin disk drives, once British Telecom has installed another telephone line.

Dragon owners wishing to access the bulletin board will need a 300/300 baud modem and an RS232 interface.

Anyone who wishes to contribute to the bulletin board, or who has ideas about the kind of services it could offer, is invited to contact Brian Lloyd at 9 Hornbeam Walk, Witham, Essex.

German network

A GERMAN Dragon club is looking to expand its contacts with Dragon owners in other countries. Interested parties should contact Raimer Hillig, Thorkoppel 17b, 2000 Barsbuettel, West Germany.

Graphic design displays

ORON SOFTWARE has launched a graphic design pad for designing hi-res screen displays. The pad consists of 100 sheets of A4 paper marked out in a 256 x 192 screen. It costs £2.90, or £5.50 for two, from 64 Prince Street, Rochdale, Lancashire.

Colossal adventure

COMPUSENSE HAS written a version of the classic Colossal Cave adventure for the Drogon 64. The adventure is text based and only available on disk.

There is no load or save feature, due to the lack of space. The game, which should be on display at the 6809 show, costs £9.95 from Compusense, PO Box 169, 286D Green Lanes, London N13 5TN.

Modems, networks and languages

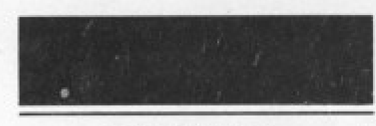
THAMES TELEVISION has launched a weekly eight-part television series for serious computer users. The series, which started on Channel 4 on February 11 at 5.30 pm, will look at modems, networks and languages such as Logo and Prolog.

In addition, the series "4 Computer Buffs', will launch a new Prestel service for schools, Schoolink. Other features will include news, gossip and data transmissions of software over the air. DIY enthusiasts will learn how to construct a light pen.

Finally, the series will be running an interactive bulletin board through Nottingham Building Society's Homelink mainframe.

New releases

LEICESTER BASED Blaby Computer Games has released three new games in its Dragon Gold Range. *Olympia!* is a sports simulation which consists of five different events in which you have to compete against the clock. *Cosmic Crusader!,* with 34 screens of action, is an interplanetary shoot'em up, while *Ruby Robba!* is a strategy game where you must steal a precious stone protected by snakes, guards and mines. All three games cost £3.99.



COSMIC CRUSADER



DRAGON 32

Blaby, which now has 17 titles to its credit, is converting its games to the Tandy Colour Computer. *Ruby Robba! Boris the Bold* and *Bells* are already available for the Tandy, also priced at £3.99.

In addition, Blaby hopes to show another three new games for the Dragon at the 6809 show in March.

Power-up

TOUCHMASTER has increased the price of its power pack for the Dragon. The new cost of the pack is £9.95 plus £1.50 P&P and not £7.50 as reported in *Dragon User* last month.

The company also announced that it is unable to help with Dragon hardware problems. The Dragon-only telephone line has been disconnected and all inquiries to the company should be made on 0656 744770.

The Demon

COTSWOLD Computers are to write Dragon software for the Unicom modem. The modem which is being renamed the Demon, retails for £49.95 (see *Dragon User,* December 1984) and is produced by the Rushworth Dales group — the organisers of the 6809 show.

It is expected that Cotswold will be exhibiting the modem and software at the show which is being held at the Royal Horticultural Halls in London, from March 30-31. Further details from Rushworth Dales on 01-930 1612.

Scramble

THE SCRAMBLE program in the February edition of *Dragon User* contained two errors. Line 1490 was misprinted. The correct data listing is:

```
DATA 0, 8, 33, 128, 0,0,0,0,0,
189, 248,0
```

Secondly, half of line 1990 was not printed. The complete line should read:

```
1990 IF (PEEK (65280) AND
1)=0 AND S <4 THEN
GOSUB 2110
```


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***Brian Cadge** takes to the skies in this review of two flight simulators*

FLIGHT SIMULATORS have come a long way since the early instrument orientated "games". The latest programs include real time 3D graphics and accurately mimic the responses of a plane in flight.

Microdeal has just released *Worlds of Flight* for the Dragon, which comes in an impressive over-sized video style box with a full size flight manual. The simulation is "view" orientated — you see the view out of the window in real time 3D graphics, which move as the plane taxies or flies. The program takes its title from the fact that there are nine worlds which you can fly around in. These "worlds" are in effect just different landscapes, including mountains, cities, islands and gulfs. There is also a useful practice world which is completely empty, apart from the airport.

Getting real-time 3D graphics on the Dragon may sound like a minor miracle, but there have been a number of trade-offs to achieve this. All the graphics are shown as wire frame drawings, rather than solid objects. The technique used is to define each world as a series of points on a three dimensional model. These points are then transformed into the aircraft's frame of reference and projected on to the screen.



The resulting points are then joined up by lines. This method is a very memory efficient technique and works quite well. However, some users might find it hard to visualise the 3D effect with just wire frames.

Worlds of Flight is written entirely in machine code and requires two potentiometer joysticks. Please note that some switch type joysticks that are now available for the Dragon cannot be used as the simulator needs to sense the position of the sticks.

After a fancy title page showing your plane, which is apparently an experimental sport trainer, doing an aileron roll, you are presented with the "Define Worlds" section. This allows you to define which world out of the nine you want to fly in. It is also possible to change the wind speed and direction, as well as setting the "Ceiling" below which the ground and other landmarks are visible. Pressing the Enter key starts the simulation.

The upper half of the display (Pmode 4) shows the view out of the aircraft's window, the lower half shows all the instruments. The airport view is always the same in every world, with the runway, control tower, fuel stations and fire station. Using the keyboard, it is possible to pan around (the equivalent of moving your head) left to right, or up and down, this is controlled by the arrow keys. Another useful viewing option is the Radar, which gives a bird's eye view of the current world, with a cross marking the plane's position. You can even zoom in on the radar.

The instrument panel shows all the essential flight information, such as a fuel gauge, speed, engine speed, artificial horizon (shows which way up you are), altimeter, compass, rate of climb, brake indicator and landing gear indicator.

The up/down movement of the left joystick controls the throttle, and the left/right movement controls the rudder. The up/down movement of the right joystick controls the elevator (ie makes the nose go up or down) and the left/right movement controls the roll rate.

Pressing both joystick buttons at once starts the engine, and once the brakes are released the aircraft begins to taxi along the runway. Following the suggested procedure for taking off in the manual, it is quite simple to become airborne. However, I found it a lot harder to land successfully!

It is apparently possible to do a number of aerobatics in the air, but plenty of practice is needed first. Once you've mastered simple flight, you can land and refuel at any airfield and continue the flight through the various worlds.

The most important part of this simulation is undoubtedly the graphics. These are flicker free, but rather slow. Also, from some angles, objects such as the control tower become twisted and totally unrecognisable. Having said that, the graphics are still by far the best I have seen on a Dragon flight simulator.

The other important aspect of any flight simulator is how accurately it copies the plane's responses. *Worlds of Flight* scores highly here — the program is very accurate in most situations.

Another flight simulator of a slightly different type to Microdeal's is *747 Flight Simulator* by DACC Ltd. As is obvious from the title, this program attempts to simulate the operation of a 747 Jumbo Jet. Again, two potentiometer joysticks are needed to use the program, and the display is a Pmode 4 screen with the upper half showing the pilot's view and the lower half the instrument panel.

The operating instructions come in a small booklet, the same size as a cassette case. I was somewhat surprised to see that the program is written in Basic, and this is reflected in the speed and complexity of the graphics.

The first six pages of the manual describe the theory of flying a 747 in a well written introduction, though it doesn't refer to the program or its operation at all. Next, comes a description of the instrument panel. None of the instruments are labelled, which is unhelpful as there are 16 small dials on the right-hand side of the display alone, giving information about each of the four jet engines. The other main gauges displayed are airspeed, artificial horizon, compass, speed, altimeter, rate of turn, and brake and landing gear indicators. But, each instrument is described in detail in the manual, which is generally well written.

The controls are once again via the joysticks and the keyboard. One joystick (the manual doesn't tell you which — perhaps it's more fun to find out for yourself) controls the left/right banking of the aircraft, and the nose up/down, and the other joystick is used as the throttle lever. Keyboard characters control things like brakes, landing gear, flaps etc.

The pilot's view is 3D, but you couldn't get much more basic — a couple of angled lines show the runway. Again, the operation of the aircraft is fairly accurate, which is probably why the program is so slow. If you specifically want a jumbo jet simulator, then you might consider this one.

The program itself is not bad (even if it is in Basic). Perhaps it is unfortunate that DACC's flight simulator is being compared to Microdeal's, as the latter is certainly well above the usual standard with superior features.

Program	**Cost**	**Supplier**
747 Flight Simulator	**£9.95**	DACC Ltd, 23 Waverley Road, Greater Manchester WN2 3BN
Worlds of Flight	**£8.00**	Microdeal, 41 Truro Road, St Austell, Cornwall PL25 5JE

New software for review should be sent to *Dragon User*, 12-13 Little Newport Street, London WC2H 7PP.

Draconian measures

Program: Draconian, Microdeal, 41 Truro Road, St Austell, Cornwall. **Price:** £7.95

THIS IS a space chase game that has similarities to both Phoenix and Asteroids as well as showing a certain amount of influence from Startrek. The playing area consists of a series of interconnecting sectors, each containing several triangular enemy bases. The object is to destroy these bases and thereby free astronauts held captive inside. The astronauts have then to be transported from one sector to the next, each stage getting progressively more difficult.

After choosing the background from a selection of black, white or green, in the usual Tom Mix fashion, the display reveals the main viewing screen and a long range sector scanner on the right. The latter shows your position as well as that of the enemy bases. Your vessel remains in the centre of the playing area, but can be pointed in any one of eight different directions by means of the joystick, while a background of stars and asteroids pass by, giving the illusion of movement.

The fire button releases a stream of shots in the direction of the ship's movement which will destroy almost anything in the way. Unfortunately, if you fly into the resulting explosion, you too end up as a space statistic.

Should you manage to collect all the astronauts, the sector scanner flashes at the top to show that the exit gate is open, and you can fly through this into the next sector. Points are awarded according to the number of astronauts safely transported through the exit gate. To liven up the game, enemy vessels called Dragons occasionally pursue you. Luckily, these can be shot down, which unfortunately is not the case with the Draconian, an unpleasant craft which appears if you take too long to destroy all the enemy bases.

There is on-screen scoring, one or two players can take part, and the game is nicely graded, getting more difficult as you progress. About the only thing I didn't like was the slow method of getting your name into the high-score table by using the joystick rather than the keyboard — a pointless hangover from the arcade version.

John Scriven



Move over pole position — here's speed racer

Program: Speed Racer, Microdeal, 41 Truro Road, St Austell, Cornwall. **Price:** £7.95

THERE HAVE been several attempts to produce motor racing games for the Dragon, but most show a view from above or from the side and fall far short of the versions available for Atari or Commodore computers. At last there is a version for the Dragon that can compete with games like Pole Position — in fact, it's surprising what excellent graphics have been achieved in Speed Racer.

When the game has loaded, the background can be selected, although to get a really clear picture it's worth sacrificing colour in this program and choosing a black background. The title graphics are very clever and show a computer sitting on a chequered flag with the title and author's name appearing on the monitor. The screen then clears to show maps of four different circuits. Moving the joystick jumps from one to the next, and pressing the fire button selects the particular track around which you race.

The display now shows the view from just behind the car, with the track stretching away into the distance, complete with starter waving a flag. The joystick controls left and right movement as well as acceleration and braking, and the front wheels of your car can be seen responding. The object of the game is to overtake as many other cars as possible. Indeed, should you fail to pass enough of them, you will find the game finishes after one lap. So that you know how many you need to overtake, there is an indicator at the bottom of the screen next to the speedometer.

As the race starts, one thing that is noticeable is the attention to detail. The track swings, from left to right and the background of mountains, houses, bridges, etc, moves as well, giving an excellent impression of actually being on a racing circuit. Keeping on the track is not too difficult, but there isn't much room to spare when you attempt to overtake.

Should you touch one of the other cars, there is an explosion and bits of the car fly into the air, complete with relevant sound effects. You are not penalised when you have a collison, but it takes some time to catch up with the pack when you restart. If your steering isn't all it should be and you veer on to the hard shoulder too frequently, the car stops and a little figure arrives to fit a new set of tyres!

Although I enjoy well-written arcade games and simulations, it's not often that I find one that is so addictive as Speed Racer. When you've mastered the easy circuit you can go on to one with more bends. If you can last ten miles, a figure appears with a chequered flag and your time is recorded under the circuit map. One of the best games I've seen for ages.

John Scriven



Jailbreak — Cuthbert rides again

Program: Cuthbert in the Cooler, Microdeal, 41 Truro Road, St Austell, Cornwall. **Price:** £7.95

MICRODEAL HAS been producing Cuthbert games for some time now, and there seems no end to the assortment of scrapes he gets himself into. The first few were merely arcade games with a more elaborate plot, but they have gradually become graphic adventures of increasing complexity. In the latest chapter in the saga, we find Cuthbert trapped in a prisoner of war camp, in dire need of speedy release.

The first screen shows an aerial view of the camp, and the task is to get the key from one of the guards and take it to the gate. The number of guards varies according to the difficulty level chosen, and ranges from two to eight. Cuthbert has to avoid the attentions of these guards or else they will shoot at him. Luckily, the bullets travel rather slowly, and he can avoid them and even cause the guards to shoot each other, so gaining extra points. Using the fire button speeds up his progress, but decreases the energy level.

If Cuthbert can reach the gate, he is faced with the problem of getting some identity papers from one of the guards and crossing a marsh to a bridge. Using a joystick means this task is quite difficult. The last screen sees him acquiring some money and taking a boat towards the border. The graphics aren't bad in this game, though not up to the most recent programs. Beyond the first screen the going gets quite tough, however, and you have to have very nimble fingers to reach the bridge safely. If you fail to avoid the guards, or take an early bath in the marsh, there are two more Cuthberts waiting in the wings to join the struggle for freedom.

This game has a fair amount of originality to it, but doesn't have the compulsiveness of Cuthbert in the Jungle (still my favourite), and the overall program, although reasonable, isn't quite up to others in the series.

John Scriven



The Second 6809 COLOUR SHOW

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Everyone said the first show was good! "Over 7,000 people attended ... queues formed early ... "Dragon User, Jan 85. "The show was a tremendous success" Dragon Users Group. "Many thanks for the very worthwhile 6809 show" Grosvenor Software.

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Over 60 companies and organisations will be exhibiting with **special offers** on their products.

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Large gangways and spacious rest areas will make sure you can see everything and sit in comfort when you want. The second 6809 Colour Show is a **family** show, a good day out.

HOW TO GET THERE

The Royal Horticultural Halls are just off Victoria Street a few minutes walk from Victoria or Parliament Square.

Buses 11, 24, 29, 70, 76 and 88 run up Victoria Street.

Underground stations; St. James Park (District and Circle lines), Victoria (District, Circle and Victoria lines).

There is an NCP car park in Abingdon Street, a few minutes away.

This exhibition is organised by:
Computer Marketplace (Exhibitions) Ltd.,
Part of the Rushworth Dales Group,
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Expansion port

***Hywel Francis** previews a new Dragon expansion system*

RACE ELECTRONICS latest offering from its armoury of add ons is a "Dragon expansion system". The expansion system comprises two separate parts, an interface cartridge with four LED indicators and the main expansion cartridge housing unit which is referred to in the users guide as the "back-plane unit". The interface is housed in an ABS plastic case with support legs, while the back-plane is manufactured out of steel that has been plastic coated.

The two units are connected by a 50-way ribbon cable. The cable is permanently connected to the back-plane, but is attached to the interface by an indirect edge connector and may be removed if you wish.

The interface cartridge holds the systems buffers and the multiplexer. Since the system is buffered, the unit can change cartridges while the back-plane is switched off, but the computer is on. The back-plane has its own power supply, which is a must. The Dragon's own power supply is totally inadequate to run four separate cartridges at any one time.

The unit uses only one location of the Dragon's memory (&HFEFF). This location is Poked with the number of the slot you wish to invoke (0-3).

6809 interrupts

Interrupts are signals to the CPU to temporarily halt what the CPU is doing and redirect it to another task. The Dragon only makes use of two of the 6809 interrupts, the Fast Interrupt ReQuest (FIRQ) and the Non-Maskable Interrupt (NMI).

The expansion unit handles any cartridge designed for the Dragon using these interrupt lines. However, problems may be encountered in the way that some cartridges handle interrupts. Switching from the slot containing this type of cartridge may result in an interrupt occurring at the switching moment, causing the processor to behave in an unpredictable manner.

To overcome this problem, the designers of the expansion unit recommend that such cartridges should be placed in any slot other than 0. The cartridge may now be selected in the usual way. When the time comes to exit that cartridge you simply RESET the Dragon, which will default to slot 0.

One cartridge that handles the interrupts in an odd manner is Dragon Data's disk interface. Unfortunately, it holds one of the 6809 interrupt lines in an active low condition during "stand by". But Premier DOS owners will be pleased to know that their interface does not behave in a suspect way.

Figure 2

PROTOTYPE CARD PINOUTS

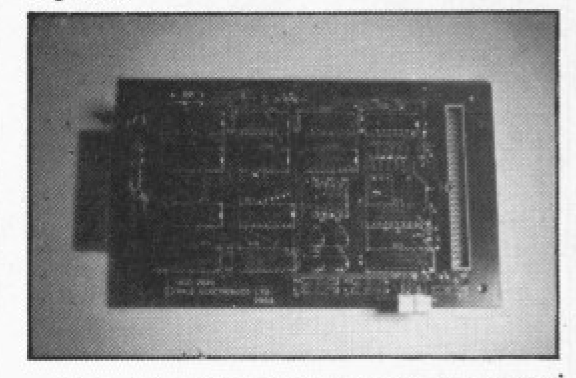
01	+12v	21	Address 2
02	+12V	22	Address 3
03	HALT	23	Address 4
04	NM1	24	Address 5
05	RESET	25	Address 6
06	E(clock)	26	Address 7
07	Q(clock)	27	Address 8
08	CART	28	Address 9
09	+5V	29	Address 10
10	DATA 0	30	Address 11
11	DATA 1	31	Address 12
12	DATA 2	32	CTS
13	DATA 3	33	GND
14	DATA 4	34	GND
15	DATA 5	35	ESND
16	DATA 6	36	P2
17	DATA 7	37	Address 13
18	Read/write	38	Address 14
19	Address 0	39	Address 15
20	Address 1	40	Ext mem

One method of removing cartridges from the back-plane is to switch off its power supply while retaining a supply to the computer. However, this will affect either the FIRQ or the NMI lines causing unpredictable behaviour to the 6809 which usually results in a crash. Race has provided information on three Poke statements within their user guide to overcome this corruption of the interrupt lines.

The 16-page users guide supplied with the system is concise and easily read. Besides containing all the pokes needed to run the system, the guide also gives details on how to utilise the Dragon 64's built-in RS232 as well as using add-on RS232 units for the 32.

Three applications are fully documented in the users guide. File transfer between Dragon DOS and the Premier Delta DOS and vice versa, BASIC and machine code programs from disk to EPROM, which can then be used in the sideways ROM board, and the third application which describes how to download a program via RS232 and store the data in EPROM.

Figure 3

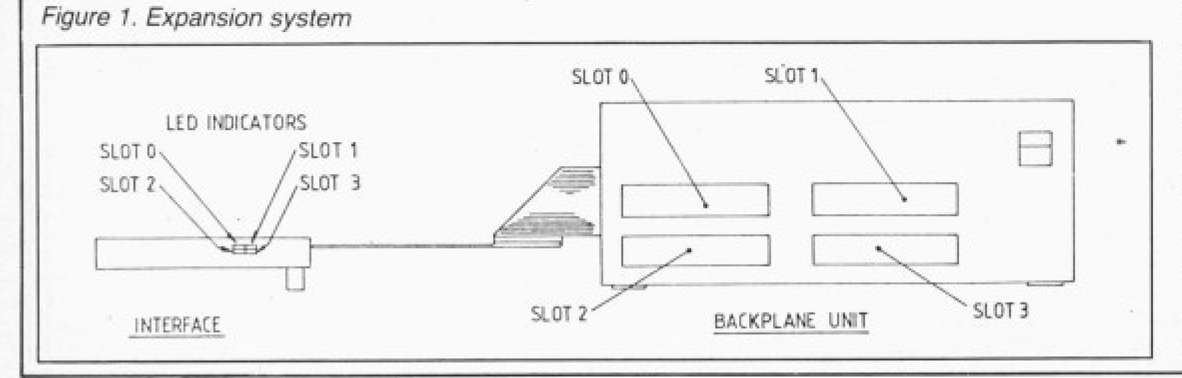


Race also included a hard copy of a relocation utility in BASIC and a 6809 assembler version written in position independent code (PIC). The utility is actually two programs in one — the first is a "keep" utility that takes the BASIC program from its original storage area and then stores it in a free part of RAM. Once the desired cartridge is selected, then the "restore" section of the utility may be invoked, which reverses the process carried out by "keep". You now have a BASIC program in the right position for execution or saving via RS232 to another computer or to EPROM.

Conclusion

This unit is extremely versatile. It really does expand the capabilities of your Dragon, whether you just wish to have four game cartridges at hand, or create a powerful 6809 development system. A great deal of thought and development time has been spent on trying to create a product that could be used with every type of commercially available and home-spun cartridge (even Dragon DOS), and it shows. The cost of the unit had not been finalised at the time of review, but it is expected to sell for around £130, which would make it a worthwhile investment.■

Figure 1. Expansion system



Mastermind!

***Xavier Devreker** presents a computerised version of the popular board game*

THIS VERSION of the popular board game *Mastermind* has been written on a Dragon 32.

You have to find the right colour combination of four different colours (don't enter the same colour twice in the same line). Clues are then given in the form of a "plus" when you have found the right colour, but at the wrong place. A "green spot" is shown for a colour at the right place.

To enter a colour, just press the corresponding number (see left side of the screen). You enter them from left to right.

If, after seven guesses, you have still not found the colour combination, you have lost.

Program Notes:

10– 17: SETS FIRST PAGE
19– 38: GIVES INSTRUCTIONS
42– 89: SETS UP HI-RES SCREEN
91– 97: CHOOSES COLOUR COMBINATION AT RANDOM
99–105: ALLOWS YOU TO ENTER YOUR COLOUR COMBINATION
107–120: PRINTS OUT YOUR CHOICE
122–126: TESTS IF A COLOUR IS WELL PLACED
128–129: LOOKS IF THE FOUR COLOURS ARE WELL PLACED
131–138: LOOKS IF CORRECT COLOURS ARE AT WRONG PLACE
140–144: SETS GREEN SPOTS
146–151: SETS PLUSES
153–162: YOU HAVE LOST
164–172: YOU HAVE WON

```
1 REM      ************************
2 REM      *M A S T E R M I N D*
3 REM      *                      *
4 REM      *XAVIER DEVREKER (C)*
5 REM      *                      *
6 REM      *   NOVEMBER 1984    *
7 REM      ************************
8 REM
9 REM**************FIRST PAGE*************
10 CLS0
11 PRINT@226,CHR$(109);:SOUND20,1:PRINTCHR$(128);CHR$(128);CHR$(97);:SOUND40,1:P
RINTCHR$(128);CHR$(128);CHR$(115);:SOUND60,1:PRINTCHR$(128);CHR$(128);CHR$(116);
:SOUND80,1:PRINTCHR$(128);CHR$(128);CHR$(101);:SOUND100,1:PRINTCHR$(128);CHR$(12
8);
12 PRINTCHR$(114);:SOUND120,1:PRINTCHR$(128);CHR$(128);CHR$(109);:SOUND140,1:PRI
NTCHR$(128);CHR$(128);CHR$(105);:SOUND160,1:PRINTCHR$(128);CHR$(128);CHR$(110);:
SOUND180,1:PRINTCHR$(128);CHR$(128);CHR$(100);:SOUND200,1:PRINTCHR$(128);CHR$(12
8);
13 PRINT@431,CHR$(98);:SOUND200,1:PRINTCHR$(121);:SOUND190,1
14 PRINT@459,CHR$(120);:SOUND180,1:PRINTCHR$(128);CHR$(100);:SOUND170,1:PRINTCHR
$(101);:SOUND160,1:PRINTCHR$(118);:SOUND150,1:PRINTCHR$(114);:SOUND140,1:PRINTCH
R$(101);:SOUND130,1:PRINTCHR$(107);:SOUND120,1:PRINTCHR$(101);:SOUND110,1:PRINTC
HR$(114);
15 SOUND100,1:PRINT@491,CHR$(123);:SOUND90,1:PRINTCHR$(99);:SOUND80,1:PRINTCHR$(
125);:SOUND70,1:PRINTCHR$(98);:SOUND60,1:PRINTCHR$(101);:SOUND50,1:PRINTCHR$(108
);:SOUND40,1:PRINTCHR$(103);:SOUND30,1:PRINTCHR$(105);:SOUND20,1
16 PRINTCHR$(117);:SOUND10,1:PRINTCHR$(109);:SOUND1,1
17 FOR Z=1 TO 1000:NEXT Z
18 REM***********INSTRUCTIONS***********
19 CLS7
20 PRINT@233,"INSTRUCTIONS ?";STRING$(9,239);
21 A$=INKEY$:IF A$=""THEN 21 ELSE IF A$="N"THEN 40 ELSE IF A$="Y" THEN GOTO 22
22 CLS
23 PRINT@10,"INSTRUCTIONS";
24 PRINT@42,"============";
25 PRINT:PRINT" THE AIM OF THE GAME IS TO FIND  THE RIGHT COLOUR COMBINATION."
26 PRINT:PRINT" THERE ARE SIX DIFFERENT COLOURS OR SIGNS AVAILABLE."
27 PRINT:PRINT" AFTER EACH GUESS, CLUES ARE      GIVEN:":PRINT
28 PRINT" ->CORRECT COLOUR AT WRONG PLACE               -PLUS-",
29 PRINT" ->CORRECT COLOUR AT RIGHT PLACE           -GREEN SPOT-";
30 PRINT@488,"<PRESS SPACEBAR>";
31 A$=INKEY$:IF A$=""THEN 31 ELSE IF A$=" "THEN 32
32 CLS
33 PRINT@10,"INSTRUCTIONS";
```

```
34 PRINT@42,"=============";
35 PRINT:PRINT" TO ENTER A COLOUR, JUST ENTER   THE CORRESPONDING NUMBER.",
36 PRINT:PRINT" THE MAXIMUM NUMBER OF GUESSES   IS SEVEN.";
37 PRINT:PRINT:PRINT:PRINT:PRINT"          GOOD LUCK...";
38 PRINT@488,"<PRESS SPACEBAR>";
39 A$=INKEY$:IF A$=""THEN 39 ELSE IF A$=" "THEN 40
40 CLEAR 100
41 REM*************SETS SCREEN***********
42 PCLS:PMODE3,1:SCREEN1,1:COLOR6,5:PCLS
43 PLAY"O1T255V20AV25AV30T20AV<T<AV<T<AV<A"
44 FOR X=9 TO 93 STEP 28
45 FOR Y=14 TO 182 STEP 28
46 CIRCLE(X,Y),9,7
47 NEXT Y,X
48 DRAW"BM121,21;U10R2F2E2R2D10L2U10D2G2H4F2D8L2"
49 DRAW"BM133,21;U10R8D10L2U4L4D4L2;BM134,16;U4R5D4L5"
50 DRAW"BM153,11;L8D1R8D1L8D4R1U4R1D4R6U1L3U1R8D4L1U4L1D4L6D1R8D1L8"
51 DRAW"BM157,11;R6D1L6D1R6L3D8L1U8L1D8U8"
52 DRAW"BM174,11;L8D1R8D1L8D8R1U8R1D8R7U1L7U1R7L7U2R4U1L4U1R4"
53 DRAW"BM182,11;R6D1L6D1R6D5L1U5L1D5L6U1R6U1L6U5D10L1U10L1D10;BM182,17;D1R1D1R1
D1R1D1R2U1L1U1L1U1L1U1L1R2D1R1D1R1D1R1D1R1"
54 DRAW"BM192,21;U10R2F2E2R2D10L2U10D2G2H4F2D8L2"
55 DRAW"BM204,21;U10R1D10R1U10"
56 DRAW"BM210,21;U10R1D10R1U10F4D2H4U2F4U4D10R1U10R1D10L2U4L2U3"
57 DRAW"BM222,11;D10R1U10R1D10R5U1L5U1R6L1U6R1D6U1R1U4L2U3L5D1R5D1L5"
58 X=200
59 CIRCLE(X,41),9,7
60 CIRCLE(X,69),9,6
61 CIRCLE(X,97),9,7
62 CIRCLE(X,125),9,8
63 CIRCLE(X,153),9,7
64 CIRCLE(X,153),2,7
65 CIRCLE(X,181),9,8
66 CIRCLE(X,181),2,8
67 PAINT(X,41),5,7
68 PAINT(X,69),6,6
69 PAINT(X,97),7,7
70 PAINT(X,125),8,8
71 PAINT(X,153),5,7
72 DRAW"BM223,33;D16R1U16R1D16"
73 DRAW"BM218,65;U4R1D4R1U4R8U1L8U1R8D6L1U6L1D6L2D1R2D1L2D1L2D1R2D1L2D1L2D1R2D1L
2D1L2R10D1L10D1R10"
74 DRAW"BM218,87;R10D1L10D1R10D14R1U14R1D14U1L12D1R10D1L10;BM226,94;L4D1R4D1L4"
75 DRAW"BM218,117;D8R1U8R1D8R10U1L10U1R10L2U3D12L1U12L1D12"
76 DRAW"BM228,144;L10D1R10D1L10D4R1U4R1D4R9U1L9U1R9D10L1U10L1D10L9D1R9D1L9"
77 DRAW"BM228,172;L10D1R10D1L10D14R1U14R1D14R6U1L6U1R6D2R2U10L1D10L1U10D2L8U1R8U
1L8"
78 LINE(120,37)-(152,45),PSET,B
79 LINE(120,65)-(152,73),PSET,B
80 LINE(120,93)-(152,101),PSET,B
81 LINE(128,37)-(136,45),PSET,B:LINE(144,37)-(144,45),PSET
82 LINE(128,65)-(136,73),PSET,B:LINE(144,65)-(144,73),PSET
83 LINE(128,93)-(136,101),PSET,B:LINE(144,93)-(144,101),PSET
84 LINE(120,121)-(152,129),PSET,B
85 LINE(120,149)-(152,157),PSET,B
86 LINE(120,177)-(152,185),PSET,B
87 LINE(128,121)-(136,129),PSET,B:LINE(144,121)-(144,129),PSET
88 LINE(128,149)-(136,157),PSET,B:LINE(144,149)-(144,157),PSET
89 LINE(128,177)-(136,185),PSET,B:LINE(144,177)-(144,185),PSET
90 REM********COLOUR COMBINATION********
91 FOR T=1 TO 4
92 C(T)=RND(6)
93 FOR I=1 TO T
94 IF I=T THEN I=I+1
95 IF C(I)=C(T) THEN I=T:NEXT I:GOTO 92
96 NEXT I
97 NEXT T
98 REM***********ENTER COLOURS**********
99 Y=210:SY=209
100 FOR T=1 TO 7
101 X=-19:SX=116
```

Continued on page 17

```
102 Y=Y-28:SY=SY-28
103 FOR I=1 TO 4
104 X=X+28
105 CH$=INKEY$:IF CH$<"1" OR CH$>"6" THEN 105
106 REM***********SETS COLOURS***********
107 CH(I)=VAL(CH$)
108 IF CH(I)<>1 THEN 110
109 CIRCLE(X,Y),9,7
110 IF CH(I)<>2 THEN 112
111 CIRCLE(X,Y),9,6:PAINT(X,Y),6,6
112 IF CH(I)<>3 THEN 114
113 CIRCLE(X,Y),9,7:PAINT(X,Y),7,7
114 IF CH(I)<>4 THEN 116
115 CIRCLE(X,Y),9,8:PAINT(X,Y),8,8
116 IF CH(I)<>5 THEN 118
117 CIRCLE(X,Y),9,7:CIRCLE(X,Y),2,7
118 IF CH(I)<>6 THEN 120
119 CIRCLE(X,Y),9,8:CIRCLE(X,Y),2,8
120 NEXT I
121 REM************RIGHT COLOUR***********
122 CR=0
123 FOR P=1 TO 4
124 IF C(P)<>CH(P) THEN 126
125 CR=CR+1
126 NEXT P
127 REM************END OF GAME?***********
128 IF CR=4 THEN 164 ELSE GOTO 131
129 IF T=7 THEN 151
130 REM************WRONG PLACE***********
131 RP=0
132 FOR P=1 TO 4
133 FOR N=1 TO 4
134 IF N=P THEN N=N+1
135 IF C(P)<>CH(N) THEN 137
136 RP=RP+1
137 NEXT N
138 NEXT P
139 REM**********SETS GREEN SPOTS*********
140 IF CR=0 THEN 146
141 FOR P=1 TO CR
142 SX=SX+8
143 PAINT(SX,SY),6,6
144 NEXT
145 REM*************SETS PLUS************
146 IF RP=0 THEN 151
147 FOR P=1 TO RP
148 SX=SX+8
149 CIRCLE(SX,SY),2,6
150 NEXT P
151 NEXT T
152 REM*************YOU LOST*************
153 CLS
154 FOR YL=0 TO 480
155 PRINT@YL,CHR$(128);"Y  O  U    L  O  S  T . . .    ";
156 NEXT YL
157 PRINT@384,"********************************";
158 PRINT@416,"<P  R  E  S  S    S  P  A  C  E>";
159 PRINT@448,"********************************";
160 PLAY"V3101T2L4GGL8B-AAGGF#G"
161 Q$=INKEY$:IF Q$=""THEN 161 ELSE IF Q$=" "THEN 40
162 GOTO 40
163 REM************YOU DID IT************
164 CLS
165 FOR YD=1 TO 480
166 PRINT@YD-1,CHR$(128);"Y  O  U    D  I  D    I  T  ! !";
167 NEXT YD
168 PRINT@416,"********************************";
169 PRINT@448,"<P  R  E  S  S    S  P  A  C  E>";
170 PRINT@480,"********************************";
171 PLAY"O2V31T5L8GAA#BO3CO2GAGEO1CO3C"
172 Q$=INKEY$:IF Q$=""THEN 172 ELSE IF Q$=" "THEN GOTO 40
```

Doodling

***John Smith** presents a turtle graphics type drawing program*

SINCE IT is not too difficult to write a program which allows drawing on the Dragon's hires screen, with the ability to give a screen dump on to the Tandy CGP 115, I decided to dabble with something approaching turtle graphics. The short listing which follows is approximately 2.5K long, and quite easy to enter. Even if you have not got a Tandy (or similar) printer/plotter, you will still get some preliminary insight before investing in a full scale professionally written package.

Only four commands are used and, since this is by no means a full implementation of turtle graphics and the finished drawing often resembles the doodles on the corner of my memo pad, I have corrupted the name to my title — "DOOTLE".

On running the program you are first presented with two introductory screens with instructions for entering data. At start up, the program sets the drawing turtle at the centre, and facing towards the top of the screen (ie, to 12 o'clock on a clock face).

The first request is to ENTER the length of the line that you want the turtle to draw. The units used are single pixels in Pmode 4. This means that a line going in any direction of a length greater than 128 from the centre will give an error message of being off screen. Lengths of 40-50 should be sufficiently large to produce a useful size without producing this error.

Figure 1

The next request is for an angle. Since the turtle is facing up at the start, an input of 90 means that the first line will be drawn to the right (or 3 o'clock) while an input of 120 will draw to 4 o'clock, and so on. The next command appears as REPEAT, which refers to the number of times you want the line of the length you have entered to be drawn at the specified angle.

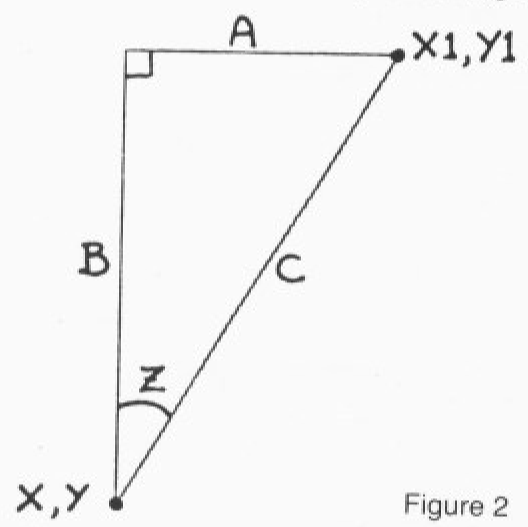


Figure 2

If we take a line of 40 units and an angle of 120 degrees drawn three times, we will end up with the drawing in Fig 1. You will see that the rotation of the line is clockwise (although this can be altered to anticlockwise by entering a negative value for the angle) and that the angle is on the outside of the triangle ie you do not specify 60 degrees to draw a triangle.

This gives a simple rule for drawing polygons, namely 360/number of sides = the angle to be used for drawing. Thus, a pentagon is drawn by 72 degree angles and an octagon by 45 degrees. With a sufficiently large number of sides, the drawing approaches a circle (try angles of 10 degrees repeated 36 times).

The whole program relies on simple trigonometry to produce its effects and the equations used are at the subroutine on line 3000. Fig 2. helps explain how these equations are derived:

Since sine Z=A/C and cosine Z=B/C

A=C × sine Z and B=C × cosine Z.

Therefore X1=X+A and Y1=Y−B.

Each time the subroutine is called, X1 and Y1 are recalculated for each increase in angle by Z (Z being the angle converted to radians by dividing by 180/pi, which equals 57.29577951).

The command to vary the line is LENGTH VARIATION. This changes the

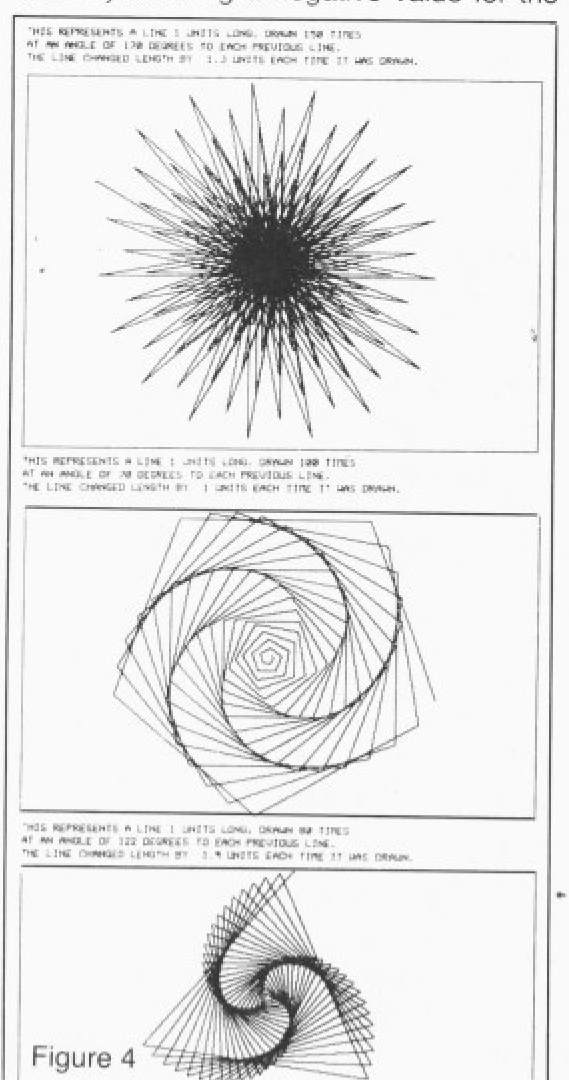


Figure 4

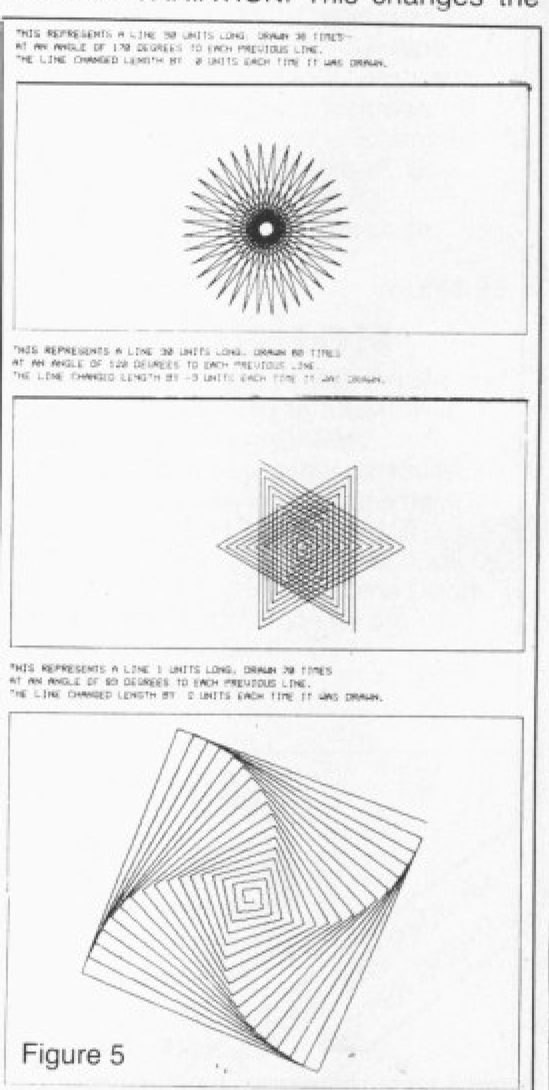


Figure 5

original line length by one unit each time it is drawn (negative values giving a reduction and positive ones an increase). To take the triangle again, if the line is drawn six times reducing it by two units each time we end up with Fig 3.

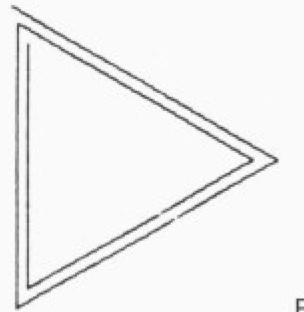


Figure 3

These are just some suggestions and you will find that with experimentation some very interesting results can be obtained. Try the values given in the accompanying table.

Length	:Angle	:Repeat	:Variation
1	170	150	1.3
1	70	100	1
1	83	50	1
60	100	18	0
90	170	36	0

Having entered your values the program then draws, in high resolution. If, however, any of the values are such that the drawing will go outside the screen area, then an error message to that effect will appear. You are then returned to the values entry stage again. Note that the previously entered four values always remain on screen, so you can adjust one or more of these to try to bring the drawing back on to the screen again.

If the drawing is completed, it remains on view for a short time and then you are returned to the text screen with three choices: 1) View the drawing again by pressing the spacebar (and return to text screen by pressing any key). 2) Start a new drawing (again the previous values remain to give you something to work from to obtain any particular effect). 3) Dump the drawing to the Tandy CGP 115 printer/plotter.

If you do not have a printer/plotter then you can make the screen output more interesting by changing program lines 70 and 190 as follows:

70 X=128:Y=96:RR=0:PMODE3,1:PCLS5

190 COLORRND(3)+1:LINE(X,Y)−(X1,Y PSET

This gives a random coloured design which is even more effective. Happy Doodling. ■

PROGRAM LISTING

Numeric Variables

- *P* = Print position for input of data.
- *U* = Print position for error and help messages.
- *C* = Length of line.
- *S* = Angle to draw line.
- *T* = Number of limes to draw line.
- *C1* = Change in length of line.
- *C2* = Temporary storage for length variable (C), to allow trigonometry functions to be calculated.
- *X,Y* = Starting point for drawing each line.
- *A,B* = Relevant variation in X and Y for each direction change.
- *X1,Y1* = End point for drawing each line.
- *RR* = Starting direction for each line.
- *R* = New angle for next calculation (=S+RR).
- *Z* = Angle R in radians.
- *D* = Loop variables.

String Variables

- *P$* = Inverse space character.
- *PR$* = Inverse "PRESS" (to save program space.
- *Q$* = Reads key pressed for continuing with the various program functions.

PROGRAM STRUCTURE.

10-50	Introductory screens with instructions.
60	Set variables and clear text screen to black.
70	Set up Hires screen and start-point at centre, with initial direction towards 12 o'clock.
80-110	Enter data for program to carry out drawing (subroutine 5000 blanks out previous values).
120	Gosub 6000 — clear screen and print drawing parameters.
130	Store length in a separate variable to allow calculation of trig. functions without altering starting length.
140	Make Hires screen visible.
150	Draw limits of usable screen area.
160-210	Set up loop to draw lines the required number of times.
170	Gosub 3000 — Set old line direction (RR) to new direction (R) by adding angle parameter (S) and convert this to radians (Z). Using Z calculate changes in position for drawing to X1 and Y1
180	If drawing goes off screen, put up error message (subroutine 1000).
190	Where all the action takes place. This draws each new line.
200	Subroutine 4000 — change all drawing end points to the next start points and change length of line if so required.
220	Delay to view drawing.
230	Instructions to view drawing again, use printer or start a new drawing.
240	Use Inkey$ to select appropriate action using subroutines.
250	Subroutine 2000 (see below).
260	Subroutine 7000 (View screen again and return).
270	Start new drawing.
Subroutines	
500	Beep after each input.
2000	Printer/plotter. Increase values by 1.8 to make full use of width of paper.
2010	Set text to 80 characters per line.
2020	Print draw parameters and move to centre.
2040	Loop to start drawing using the same subroutines as above.
2050	Draw the line.
2060	Use subroutine 4000 to calculate new direction and length for line.
2080/2090	Draw limits of area as on screen.
2100	Return to text mode.
2110	Return C1 to screen size in case a second print is required.
8000	Use of spacebar to change introductory screens.

```
1 '******************
2 '****  DOOTLE  ****
3 '****    BY    ****
4 '****J.A. SMITH****
5 '**** 11/10/84 ****
6 '******************
10 CLS
20 PRINT@13,"DOOTLE"
30 PRINT@99,"THIS IS A DEMONSTRATION OF
     DRAWING  USING SEMI-TURTLE       COM
MANDS, WITH THE ABILITY      TO OUTPUT H
ARD COPY......        if a printer is con
nected.":PRINT:PRINT:PRINT:PRINT:PRINT"
  PRESS SPACEBAR TO CONTINUE":GOSUB8000:
GOSUB500:CLS
40 PRINT@64,"YOU WILL BE ASKED TO enter
FIRSTTHE length OF LINE AND THEN THE ang
le AT WHICH SUBSEQUENT LINES ARE TO BE D
RAWN.THE NEXT REQUESTIS FOR THE NUMBER O
F TIMES YOU  WISH TO repeat THIS ACTION.
 THE FINAL INPUT IS HOW MUCH YOU WANTTHE
 LINE TO";
50 PRINT" vary BY EACH TIME ITIS DRAWN.
 ( USE NEGATIVE VALUESTO DECREASE.)":PRI
NT:PRINT:PRINT"   PRESS SPACEBAR TO CONT
INUE":GOSUB8000:GOSUB500
60 P$=CHR$(128):P=96:U=352:PR$="press":C
LS0
70 X=128:Y=96:RR=0:PMODE4,1:PCLS5:COLOR0
,5
80 GOSUB5000:INPUT"length";C
90 GOSUB5000:GOSUB500:INPUT"angle";S
100 GOSUB5000:GOSUB500:INPUT"repeat";T
110 GOSUB5000:GOSUB500:PRINT"length";P$;
"variation";:INPUTC1
120 GOSUB6000
130 C2=C
140 SCREEN1,1
150 LINE(0,0)-(255,191),PSET,B
160 FORD=1 TOT
```

Figure 6

Continued on page 21

```
170 GOSUB3000
180 IFX1>255ORX1<0ORY1<0ORY1>191 THENGOS
UB1000:GOSUB6000:GOTO70
190 LINE(X,Y)-(X1,Y1),PSET
200 GOSUB4000
210 NEXTD
220 FORK=1 TO5000:NEXT
230 PRINT@U,"to";P$;"view";P$;"again";P$
;PR$;P$;"SPACEBAR";P$;P$;P$;P$;"then";P$
;"any";P$;"key";P$;"to";P$;"return";STRI
NG$(10,128);"to";P$;"use";P$;"printer";P
$;PR$;P$;"P";STRING$(10,128);"to";P$;"dr
aw";P$;"again";P$;PR$;P$;"D";STRING$(11,
128);
240 Q$=INKEY$
250 IFQ$="P" THENGOSUB500:GOSUB2000
260 IFQ$=" " THENGOSUB500:GOSUB7000
270 IFQ$="D"THENGOSUB500:GOTO70ELSE240
500 PLAY"O5L50C":RETURN
1000 SCREEN0,1:PRINT@U,"outside";P$;"ava
ilable";P$;"screen";P$;"area";STRING$(3,
128);"reduce";P$;"value";P$;"of";P$;"one
";P$;"or";P$;"more";STRING$(5,128);"entr
ies";:FORK=1 TO5000:NEXT:PCLS5:RETURN
2000 C2=1.8*C:C1=1.8*C1:X=230:Y=172:RR=0
2010 PRINT#-2,CHR$(18):PRINT#-2,"S0":PRI
NT#-2,"A"
2020 PRINT#-2,"THIS REPRESENTS A LINE";C
;"UNITS LONG, DRAWN";T;"TIMES":PRINT#-2,
"AT AN ANGLE OF";S;"DEGREES TO EACH PREV
IOUS LINE.":PRINT#-2,"THE LINE CHANGED L
ENGTH BY ";C1/1.8;"UNITS EACH TIME IT WA
S DRAWN."
2030 PRINT#-2,CHR$(18):PRINT#-2,"M230,-1
72":PRINT#-2,"D230,-172"
2040 FORD=1 TO T:GOSUB3000
2050 PRINT#-2,"D";X1",";-Y1
2060 GOSUB4000
2070 NEXTD
2080 PRINT#-2,"M0,-350"
2090 PRINT#-2,"D480,-350,480,0,0,0,0,-35
0"
2100 PRINT#-2,"A"
2110 C1=C1/1.8:RETURN
3000 R=S+RR:Z=R/57.29577951:A=INT((C2*SI
N(Z))+.5):B=INT((C2*COS(Z))+.5):X1=X+A:Y
1=Y-B:RETURN
4000 RR=R:X=X1:Y=Y1:C2=C2+C1:RETURN
5000 PRINT@P,STRING$(32,128);:PRINT@P,""
;:RETURN
6000 CLS0:GOSUB500:PRINT@0,"length";C,"a
ngle";P$;P$;P$;P$;S,"repeat";T,"variatio
n";C1:RETURN
7000 SCREEN1,1:Q$=INKEY$:IFQ$=""THEN7000
ELSESCREEN0,0:RETURN
8000 Q$=INKEY$:IFQ$<>" "THEN8000ELSERETU
RN
```

Please note that lower case lettering represents inverse characters on the DRAGON, i.e. SHIFT key with 0.

Sequential files on tape

***Robin Hamilton** explains how sequential file techniques can be used to create a 200K database on tape*

THERE ARE numerous data-base programs in existence for the Dragon 32, from the simplest to the most complicated, both commercial tapes and listings published in magazines. Unfortunately, most that rely on cassette rather than disk for data-storage have a radical limitation — they accept the 32K memory of the Dragon as an upper limit for the total amount of data which the program can deal with.

For simplicity's sake, "32K" is used as shorthand for whatever amount of memory is left for string-data, after the Basic program has taken its byte, and the memory has been further used up by dimensioning arrays, assigning variables, and so on. This will obviously be less, often much less, than the notional 32K available initially after PCLEAR1 has been executed.

The following sort routine is a standard version of the Shell sort, but it makes use of the Dragon's VARPTR function. It can be between five and 10 times faster than a sort program which directly switches arrays rather than (as this does) switching the array pointers (N = number of items to be sorted and D$(number) is the array holding these items).

Next, you should examine the LOAD and SAVE routines. These come in two forms. The simpler reads or writes a number at the start which gives the number of items in the array to be saved or loaded. This number is then used when reading or writing data to or from tape, to indicate when to stop loading or saving. For our purposes, this is quite useless as it effectively prevents a file on tape from being appended to one already in the computer. The routine to use, more complicated but more elegant, is the one which employs the Dragon EOF function.

There are a number of techniques which can be used to extend this limit to the maximum amount of data which can be held on cassette rather than in Ram. Conceivably, a two-hour audio-cassette could be used to hold the data, but there is an overhead in terms of time — accessing the final item of data on a two-hour cassette, however you go about it, does take two hours. But, using the techniques described here, it should be possible to create a database of about 200K on a C20 cassette, and access it relatively easily.

```
7500 REM *** SORT SUBROUTINE ***
7505 N=N-1
7510 CLS: PRINT "SORTING ... PLEASE WAIT"
7520 Y=1
7530 Y=2*Y
7540 IF Y<N THEN 7530
7550 Y=INT((Y-1)/2)
7650 IF Y=0 THEN 7730
7660 IT=N-Y
7670 FOR I=1 TO IT
7680 J=1
7690 W=J+Y
7700 IF D$(W)<D$(J) THEN 7740
7710 NEXT I
7720 GOTO 7550
7725 CLS: PRINT "SORT COMPLETED"
7730 N=N+1: RETURN
7740 FOR C=0 TO 2
7750 B=C: IF B>0 THEN B=B+1
7760 Y1=PEEK(VARPTR(D$(W))+B)
7770 Y2=PEEK(VARPTR(D$(J))+B)
7780 POKE(VARPTR(D$(W))+B),Y2
7790 POKE(VARPTR(D$(J))+B),Y1
7800 NEXT C
7805 J=J-Y
7810 IF J>0 THEN 7690
7820 GOTO 7710
```

Fig 1

Original database

There are certain features your original database program should have. These are:

Routines to create files
Routines to insert, amend, and delete records
Routines to load and save data to tape
Routines to search for records
A sort routine to arrange the records in order

All these routines are fairly standard. The only one which is sometimes omitted from database programs is the sort routine. If you are buying a database program, or building one from scratch, make sure you pick one with a sort routine. If you have a database program without a sort routine, write one in as a subroutine.

Here are the bad and the good versions (Figs 2 and 3) — if you have the former, simply replace it by the latter. Both versions presuppose a variable N in the program which holds the number of items currently in the file, and an array D$(large number greater than N) created by the program to hold the records.

The purpose of the variables in line

1005, and their use in line 1020, rather than the more obvious 1 TO N, will emerge in due course. This part of the routine is actually simpler than the earlier version, since you don't have to print the number to the tape to start with!

This routine is at once more elegant and less easy to understand than the earlier version. What it does is read the tape and, if the end-of-file marker is encountered, return from whence it was called. Otherwise, it increments the variable counter holding the number of items in the file by one, reads one data item from the tape into the array set up in the program to hold the records, and then repeats the process until the end-of-file marker is found. At this stage, it will return to the main program with N set to the number of items currently in the file. If there is no data in the program to start with, then N will equal the number of items loaded; if the program already holds data, then N equals the number of items held plus the number of items loaded.

```
1000 REM *** BAD SAVE ROUTINE ***
1010 OPEN "O", #-1, "DATA"
1020 PRINT #-1, N
1030 FOR A=1 TO N
1040 PRINT #-1, D$(A)
1050 NEXT A
1060 CLOSE #-1
1070 RETURN

1200 REM *** BAD LOAD ROUTINE ***
1210 OPEN "I", #-1, "DATA"
1220 INPUT #-1, N
1230 FOR A=1 TO N
1240 INPUT #-1, D$(A)
1250 NEXT A
1260 CLOSE #-1
1270 RETURN
```

Fig 2

Incidentally, if you want to save a string beginning with double quotes, simply replace INPUT by LINE INPUT. This follows the same syntax and has the same constraints as LINE INPUT taking data from the keyboard.

With a SORT routine included, and the EOF version of the LOAD/SAVE routine, we now have the program running and can work within the 32K limit. Now we add the frills.

```
1000 REM *** GOOD SAVE ROUTINE ***
1005 B=1 : E=N
1010 OPEN "O", #-1, "DATA"
1020 FOR A=B TO E
1030 PRINT #-1, D$(A)
1040 NEXT A
1050 CLOSE #-1
1060 RETURN

1200 REM *** GOOD LOAD ROUTINE ***
1210 OPEN "I", #-1, "DATA"
1220 IF EOF(-1) THEN CLOSE #-1: RETURN
1230 N=N+1
1240 INPUT D$(N)
1240 GOTO 1220
```

Fig 3

The first frill is the ability to APPEND files from tape, which will be essential later. This will enable you to create two separate files, add them together, and merge them using the SORT routine (assuming, that is, that the files are in the same form — for example, simple strings held as part of a string array). Even this by itself can be useful, if you can imagine five separate Dragon programmers each putting some items into a database on their individual computers, then getting together to combine the files. In certain situations, this would spread the misery of data-entry five ways.

When the program is first run, N is set to 1. This is because the program creates an end-of tape marker when it is set up, which will always come at the end of the final file in a series on tape. The main menu will present an option "3. LOAD FILES FROM TAPE". When option 3 is chosen, you're sent to the LOAD subroutine at line 1200, the file is loaded from tape, and N is now set to the current number of items in the file. To append a further file, simply use the same option as it stands.

As the new file is loaded, N is incremented by 1 as each record is input, and when the file has finished loading, you're returned to the main menu with N now reset to the number of items in the file currently held by the program. You can now carry on adding files up to the limit of the computer memory, and merge these files into one by means of SORT.

Assuming that we have now created a data file which takes up the whole of the available computer memory, and wish to add to this, what do we do? This is the second frill, the reverse of APPENDing files. We break the file into two parts (Fig 4).

```
2000 REM *** SPLIT FILE IN TWO ***
2010 INPUT "BREAK FILE AT WHICH LETTER"; L$
2020 M=1
2030 IF LEFT$(D$(M)>L$ THEN 2050
2040 M=M+1 : GOTO 2030
2050 INPUT "PRESS ANY KEY TO SAVE FIRST FILE"; K$
2060 B=1 : E=M-1
2070 GOSUB 1010
2080 INPUT "PRESS ANY KEY TO SAVE SECOND FILE"; K$
2090 B=M : E=N
2100 GOSUB 1010
2110 PRINT "SAVE COMPLETED"
2120 RETURN
```

Fig 4

By the use of this routine, we can create two separate files, each of which (ideally) will take up approximately half of the available computer memory. Further items can now be loaded into the file.

First, start a completely fresh file and insert records up to the limit of available memory, or until you reach a convenient point to process this file. SORT this new file into order, and divide it into two at the same point that you divided your original file. Clear the program, and load in the first part of the original file, then append the first part of the new file to this, sort the result, and save the new, large sorted file on a fresh tape.

Next clear the program and do the same with the second part of the original file and the second part of the new file. Save this file on the same tape that you saved the combined part one, immediately after it. If this is done correctly, you will now have a cassette containing approximately 60K of data in an ordered sequence.

The purpose of the variables B and E should now have emerged — they allow us to break into the SAVE routine and specify which parts of the file currently in the program are to be saved. They would originally be set up as part of an initialisation routine something like the example in Fig 5.

The process of splitting files, adding to them, and recombining, can be done indefinitely, up to the limit of data that the cassette can hold. The problem with this is that only part of the data can be held in the Dragon's memory at any one time.

```
100 PCLEAR1 : CLEAR 20000
110 DIM D$(300)
120 N=1 : B=1 : E=1
130 D$(N)="ZZZZZ"
```

Fig 5

```
10 CLS
100 PCLEAR1: CLEAR 20000
110 DIM D$(300): DIM T$(30)
120 N=1 : B=1 : E=1: CT=1
130 D$(N)="ZZZZZ"
```

Fig 6

To get round this problem, we create a routine to search each of the files on tape one after the other, and to store the results of this search in an array which has been created specially to hold them. At the moment, our initialisation routine has created an array D$(x) to hold our records, and sets N=1 : B=1 : E=1. We now add T$(30), to create an array of 30 elements to hold items found by the search program, and a variable flag CT, which will signal whether the search routine is to simply scan the file currently in memory, or is to load further files and scan these too. The beginning of our program will now read something like Fig 6.

A very primitive search routine, which would search through a complete file for

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the occurrence of a specified string, and store the results of this search in a temporary file, is contained in Fig 7.

Lines 3060 and 3070 mean that if the CT flag is set to 1, or if the last record in the current file is "zzzzz" (the end-of-tape marker), then the search will be terminated after the current file in memory has been searched. Otherwise, the computer will automatically load a further file from tape, search it, and store the results of the search in T$. Lines 3080, 3090, and 3100 blank the array without destroying the contents of the variables, call the LOAD subroutine, and start the SEARCH routine once more on the new file just loaded.

Automatic scanning

If you want to simplify the process, or make the scanning of multiple files automatic, simply omit lines 3005, 3006 and 3060.

Assuming that the files to be searched are stored one after the other on a single tape, then the computer will get on with the job of searching without needing any attention till the search has been completed. The process may be time-consuming, but as it is automatic, you can busy yourself at other pursuits (or trying to work out where to get the money to buy a disk drive, and make such expedients as this unnecessary) until the search has been finished. Possibilities here would be to make the computer set off a repeated beep when the search is finished to draw your attention to it, or have the search output its results to the printer rather than storing them in a temporary array in the computer memory.

```
3000 REM *** SEARCH SUBROUTINE ***
3005 CLS: INPUT "SEARCH MULTIPLE FILES (Y/N)"; S$
3006 IF S$="Y" THEN CT=0 ELSE CT=1
3010 INPUT "TYPE IN WORD TO BE SEARCHED FOR"; W$
3020 T=0
3030 FOR A=1 TO N
3040 IF INSTR(D$(A),W$)<>0 THEN T=T+1: T$(T)=D$(A)
3050 NEXT A
3060 IF CT=1 THEN 3500
3070 IF D$(N)="ZZZZZ" THEN 3500
3080 FOR A=1 TO N : D$(A)="" : NEXT A: N=1
3090 GOSUB 1210
3100 GOTO 3030
3500 PRINT "SEARCH COMPLETE"
3510 RETURN
```

Fig 7

With these various fairly simple routines implemented as part of your database program, this program will now be able to deal with a much greater amount of material, both in terms of storing this material and processing it. The examples given in this article are, obviously, as close to the bare bones as can be, but this is no reason why the same techniques — of appending files, splitting files, merging separate files, and searching through a multiple set of files on tape, can't be incorporated into the routines of much more sophisticated database programs.

The most difficult technique to implement is probably the routine to search through a series of files, but even this is fairly straightforward if you recognise what is being done — rather than terminating the search when the file in memory has been examined, a fresh file is loaded and the search routine is simply rerun on this new file. The price paid for using the cassette in this fashion, as if it were a sequential disk-drive, is not so much the programming involved, since the Dragon cassette routines are very much the same as certain disk routines, but the time it takes to access data. However, even this is partly compensated for since such access is automatic, and the computer can be left to attend to this by itself. ■

Task Master

***John Nash** looks at some of the mysteries of the interrupt routine*

MULTI-TASKING IS common on larger computers and refers to the operation of two or more procedures or programs at the 'same' time. Actually, the programs are interleaved so that, for example, the processor can update the video display while waiting for the operator to press the next key. One way of achieving this is by using interrupts.

Interrupts are signals sent to the processor, for example a peripheral is ready to donate or accept data. They cause the processor to stack enough information to remember where it was working, then jump to the interrupt service routine. When the service routine is finished, the processor can return to its previous task. The effect is rather like being called to dinner while you are reading your programmer's manual: you mark the place, then go to dinner (service the interrupt). Afterwards, you carry on from the place you marked.

How does this apply to the Dragon? You may have noticed that the Dragon becomes totally unresponsive while printing programs or data on to paper. This is because the processor waits in a loop, constantly checking a flag for printer 'not busy'. As soon as the flag is clear, the next character is sent to the printer (to see how this works, inspect your ROM contents from $BCF5 to $BD08). This loop wastes a lot of time, as the printer is very slow compared with the processor.

There is an alternative method that can be used — the printer has an acknowledge 'ACK' line which is connected to the FIRO (fast interrupt) input, and can be used from machine code. The Dragon operating system does not use it. Two examples of programs using this interrupt are described below.

1) A Basic program lister (Fig 1), which first copies an expanded (ie de-tokenised) version of the listing into upper memory. This is necessary to isolate the Basic program (and especially current line buffer) from the listing so that you can actually do something useful while the program is listing. You will find that you can now use the Basic system to edit, calculate or even program while the printer is working. There is a limit on program length of about 8K bytes, but you could fit in a longer program by doing a PCLEAR N operation with N<4. The program will alert you if the expanded version is too long to fit into the top half of memory.

```
                    00090 *BASLIST: BASIC LISTING WITH
                    00100 *INTERRUPTED PRINTING ON THE DRAGON
3F00                00110          ORG     $3F00
           0019     00120 BASBEG   EQU     $19      /START OF BASIC PROG.
           001B     00130 VARBEG   EQU     $1B      /START OF VARS
           7FFF     00140 MEMEND   EQU     $7FFF    /$78FF FOR DELTA DISK SYSTEM USE
           00E6     00150 PRIEND   EQU     $E6      /TEMP. STORE
           02DD     00160 BUFFER   EQU     $2DD     /USED BY LINE EXPAND
           BA5F     00170 CLS      EQU     $BA5F
           957A     00180 PRINO    EQU     $957A    /PRINTS NUMBER ON SCREEN
           8F08     00190 LINEXP   EQU     $8F08    /LINE EXPAND
           BCF5     00200 CHPRIN   EQU     $BCF5    /LINE PRINTER
           800C     00210 SCREEN   EQU     $800C
3F00                00220 NEXTLI   RMB     2        /NEXT LINE START
3F02                00230 POSITN   RMB     2        /USED BY INT. HANDLER
3F04 1A    10       00240 START    ORCC    #$10     /IRQ OFF
3F06 9E    1B       00250          LDX     VARBEG
3F08 8C    3EFE     00260          CMPX    #$3EFE
3F0B 1024  0095     00270          LBHS    ERROR    /TOO LONG
3F0F 9E    19       00280          LDX     BASBEG
3F11 108E  3FD3     00290          LDY     #STORE
3F15 86    0D       00300          LDA     #13
3F17 A7    A0       00310          STA     ,Y+      /C.R.
3F19 EC    81       00320 LINE     LDD     ,X++
3F1B FD    3F00     00330          STD     NEXTLI
3F1E 34    30       00340          PSHS    X,Y
3F20 4F             00350          CLRA
3F21 BD    BA5F     00360          JSR     CLS
3F24 35    30       00370          PULS    X,Y
3F26 EC    84       00380          LDD     ,X
3F28 1E    12       00390          EXG     X,Y
3F2A 34    30       00400          PSHS    X,Y
3F2C BD    957A     00410          JSR     PRINO    /PUT NUMBER ON SCREEN
3F2F 35    20       00420          PULS    Y
3F31 8E    0400     00430          LDX     #$400
3F34 A6    80       00440 LOOP1    LDA     ,X+
3F36 80    40       00450          SUBA    #$40     /CORRECT & STORE IT
3F38 A7    A0       00460          STA     ,Y+
3F3A 8C    0404     00470          CMPX    #$404
3F3D 23    F5       00480          BLS     LOOP1
3F3F 86    20       00490          LDA     #32      /SPACE
3F41 A7    A0       00500          STA     ,Y+
3F43 35    10       00510          PULS    X
3F45 30    1E       00520          LEAX    -2,X
3F47 34    30       00530          PSHS    X,Y
3F49 BD    8F08     00540          JSR     LINEXP   /EXPAND LINE
3F4C 35    30       00550          PULS    X,Y
3F4E 8E    02DD     00560          LDX     #BUFFER
3F51 A6    80       00570 LOOP2    LDA     ,X+
3F53 27    04       00580          BEQ     LINDON
3F55 A7    A0       00590          STA     ,Y+      /COPY BUFFER
3F57 20    F8       00600          BRA     LOOP2
3F59 BE    3F00     00610 LINDON   LDX     NEXTLI
3F5C A6    84       00620          LDA     ,X
3F5E 27    07       00630          BEQ     OUT      /SECOND ZERO = FINISHED
3F60 86    0D       00640          LDA     #13
3F62 A7    A0       00650          STA     ,Y+
3F64 16    FFB2     00660          LBRA    LINE
3F67 86    0D       00670 OUT      LDA     #13
3F69 A7    A0       00680          STA     ,Y+
3F6B A7    A4       00690          STA     ,Y
3F6D 108C  7FFF     00700          CMPY    #MEMEND
3F71 22    31       00710          BHI     ERROR    /OVERSHOT!
3F73 109F  E6       00720          STY     PRIEND
3F76 CC    3FD3     00730          LDD     #STORE
3F79 FD    3F02     00740          STD     POSITN   /GET READY TO PRINT
                    00750 *INTERRUPT ENABLE
3F7C CC    3F8D     00760          LDD     #INSTAR
3F7F FD    0110     00770          STD     $110     /VECTOR
3F82 86    35       00780          LDA     #$35
3F84 B7    FF21     00790          STA     $FF21    /ENABLE FIRQ
3F87 86    0D       00800          LDA     #13
3F89 BD    BCF5     00810          JSR     CHPRIN   /START PRINTER TO GENERATE 'ACK'
3F8C 39             00820          RTS              /RETURN FROM S/R WITH INTERRUPTS
                    00830 *INTERRUPT HANDLER
3F8D 34    16       00840 INSTAR   PSHS    D,X
3F8F B6    FF20     00850          LDA     $FF20    /CLEAR FLAG
3F92 BE    3F02     00860          LDX     POSITN
3F95 A6    80       00870          LDA     ,X+
3F97 BF    3F02     00880          STX     POSITN
3F9A 9C    E6       00890          CMPX    PRIEND
3F9C 22    18       00900          BHI     INACT1   /I.E. FINISHED
3F9E BD    BCF5     00910          JSR     CHPRIN
3FA1 35    16       00920 INACT2   PULS    D,X
3FA3 3B             00930          RTI
3FA4 8E    3FC2     00940 ERROR    LDX     #MESSAG
3FA7 A6    80       00950 LOOP3    LDA     ,X+
3FA9 81    25       00960          CMPA    #'%
3FAB 27    12       00970          BEQ     ERRRET
3FAD 34    10       00980          PSHS    X
3FAF BD    800C     00990          JSR     SCREEN
3FB2 35    10       01000          PULS    X
3FB4 20    F1       01010          BRA     LOOP3
3FB6 86    34       01020 INACT1   LDA     #$34
3FB8 B7    FF21     01030          STA     $FF21
3FBB 1C    EF       01040          ANDCC   #$EF     /IRQ ON
3FBD 20    E2       01050          BRA     INACT2
3FBF 1C    EF       01060 ERRRET   ANDCC   #$EF
3FC1 39             01070          RTS
3FC2       50       01080 MESSAG   FCC     /PROGRAM TOO LONG%/
           52
           4F
           47
           52
           41
           4D
           20
           54
           4F
           4F
           20
           4C
           4F
           4E
           47
           25
           3FD3     01090 STORE    EQU
           0000     01100          END
00000 TOTAL ERRORS
```

Fig 1

2) This is an interrupted printing routine (Fig 2) which can be used with a word processor. It assumes that the text will start at address 135000 decimal, and the following codes are used:

CHR$(91)	NEW LINE.
CHR$(93)	NEW PARAGRAPH.
CHR/(94)	DOUBLE SIZE.
CHR$(95)	SINGLE SIZE.

These could be altered to suit text from any word processor.

Both routines are intended as illustrations of the interrupt control method, to encourage you to experiment. Please use any parts of them that seem useful in your own programs.

To load these programs, first clear the memory space:

CLEAR 200,&H3EFF for BASLIST
CLEAR 200,&H2EDF for WPINT.

Next load the hex dump into DATA statements (one program at a time). The left hand column holds the addresses while, the remaining 16 columns add the data (instructions). Do not, therefore, load the left hand column. Your first DATA line for BASLIST should start:

```
10 DATA 1A,10,9E,1B,8C etc.
```

When you have loaded all the DATA into lines 10 onwards, enter the following:

```
5 INPUT"START,FINISH";S,F
6 FOR N=S TO F
7 READ A$:POKEN,VAL("&H"+A$):NEXT N
8 END
```

and RUN it. START is &H3F04 and FIN-

ISH is &H3FD3 for BASLIST. START is &H2EE0 for WPRINT (extra bytes in last line of dump not needed).

When the program has finished running, immediately save it on tape with:
CSAVEM"BASLIST",S,F,1.

Do the same for WPINT. In future, you will only need to CLEAR the memory space, and CLOADM the programs to use them. They are used by typing EXEC &H3F04 instead of LLIST and EXEC &H2EE0 to print out the word processor file.

NOTE: The IRQ is intentionally disabled during the running of these programs, so TIMER, PLAY etc will not work concurrently. ■

```
                    00090 *WPINT
                    00100 *WORD PROCESSOR INTERRUPTED PRINTING FOR DRAGON
2EE0                00110          ORG     12000
2EE0 1A    10       00115          ORCC    #$10     /IRQ OFF
2EE2 8E    34BC     00120 START    LDX     #13500   /TEXT START
2EE5 BF    2F5C     00130          STX     POSN
2EE8 8E    2EFA     00140          LDX     #INSTAR
2EEB BF    0110     00150          STX     $110     /VECTOR
2EEE 86    35       00160          LDA     #$35
2EF0 B7    FF21     00170          STA     $FF21    /ENABLE INTERRUPT
2EF3 86    0D       00180          LDA     #13      /C.R.
2EF5 C6    01       00190          LDB     #1
2EF7 8D    4F       00200          BSR     PRINT    /START UP PRINTER
2EF9 39             00210          RTS
                    00220 *INTERRUPT ROUTINE
2EFA B6    FF20     00240 INSTAR   LDA     $FF20    /CLEAR FLAG
2EFD 34    10       00250          PSHS    X
2EFF BE    2F5C     00260          LDX     POSN
2F02 A6    80       00270          LDA     ,X+
2F04 BF    2F5C     00280          STX     POSN
2F07 BC    2F5E     00290.         CMPX    TEXEND
2F0A 24    47       00300          BHS     INTOFF
2F0C 81    5B       00310          CMPA    #91
2F0E 27    13       00320          BEQ     NL       /NEW LINE
2F10 81    5D       00330          CMPA    #93
2F12 27    22       00340          BEQ     PARA     /PARAGRAPH
2F14 81    5E       00350          CMPA    #94
2F16 27    12       00360          BEQ     LARGE    /DOUBLE SIZE
2F18 81    5F       00370          CMPA    #95
2F1A 27    14       00380          BEQ     SMALL    /SINGLE
2F1C C6    01       00390          LDB     #1
2F1E 8D    28       00400 COMMON   BSR     PRINT
2F20 35    10       00420 FINISH   PULS    X
2F22 3B             00430          RTI
2F23 86    0D       00440 NL       LDA     #13      /THESE CODES MAY VARY-
2F25 F6    2F60     00450          LDB     SPACIN   /       THESE ARE FOR EPSON RX80
2F28 20    F4       00460          BRA     COMMON
2F2A 86    0E       00470 LARGE    LDA     #14
2F2C C6    01       00480          LDB     #1
2F2E 20    EE       00490          BRA     COMMON
2F30 86    14       00500 SMALL    LDA     #20
2F32 C6    01       00510          LDB     #1
2F34 20    E8       00520          BRA     COMMON
2F36 86    0D       00530 PARA     LDA     #13
2F38 F6    2F60     00540          LDB     SPACIN
2F3B 8D    0B       00550          BSR     PRINT
2F3D F6    2F60     00560          LDB     SPACIN
2F40 8D    06       00570          BSR     PRINT
2F42 86    20       00580          LDA     #32
2F44 C6    05       00590          LDB     #5
2F46 20    D6       00600          BRA     COMMON
2F48 34    15       00610 PRINT    PSHS    CC,X,B
2F4A BD    800F     00620          JSR     $800F
2F4D 35    15       00630          PULS    CC,X,B
2F4F 5A             00640          DECB
2F50 26    F6       00650          BNE     PRINT
2F52 39             00660          RTS
2F53 86    34       00670 INTOFF   LDA     #$34
2F55 B7    FF21     00680          STA     $FF21
2F58 1C    EF       00685          ANDCC   #$EF     /IRQ ON
2F5A 20    C4       00690          BRA     FINISH
2F5C                00700 POSN     RMB     2
2F5E                00710 TEXEND   RMB     2
2F60                00720 SPACIN   RMB     1
           0000     00730          END
00000 TOTAL ERRORS
```

Fig 2

HEX. DUMP FOR BASLIST

```
3F04 1A 10 9E 1B 8C 3E FE 10 24 0 95 9E 19 10 8E 3F
3F14 D3 86 D A7 A0 EC 81 FD 3F 0 34 30 4F BD BA 5F
3F24 35 30 EC 84 1E 12 34 30 BD 95 7A 35 20 8E 4 0
3F34 A6 80 80 40 A7 A0 8C 4 4 23 F5 86 20 A7 A0 35
3F44 10 30 1E 34 30 BD 8F 8 35 30 8E 2 DD A6 80 27
3F54 4 A7 A0 20 F8 BE 3F 0 A6 84 27 7 86 D A7 A0
3F64 16 FF B2 86 D A7 A0 A7 A4 10 8C 7F FF 22 31 10
3F74 9F E6 CC 3F D3 FD 3F 2 CC 3F 8D FD 1 10 86 35
3F84 B7 FF 21 86 D BD BC F5 39 34 16 B6 FF 20 BE 3F
3F94 2 A6 80 BF 3F 2 9C E6 22 18 BD BC F5 35 16 3B
3FA4 8E 3F C2 A6 80 81 25 27 12 34 10 BD 80 C 35 10
3FB4 20 F1 86 34 B7 FF 21 1C EF 20 E2 1C EF 39 50 52
3FC4 4F 47 52 41 4D 20 54 4F 4F 20 4C 4F 4E 47 25 4
```

HEX. DUMP FOR WPINT-
INTERRUPTED TEXT PRINTING FOR WORD PROCESSOR

```
2EE0 1A 10 8E 34 BC BF 2F 5C 8E 2E FA BF 1 10 86 35
2EF0 B7 FF 21 86 D C6 1 8D 4F 39 B6 FF 20 34 10 BE
2F00 2F 5C A6 80 BF 2F 5C BC 2F 5E 24 47 81 5B 27 13
2F10 81 5D 27 22 81 5E 27 12 81 5F 27 14 C6 1 8D 28
2F20 35 10 3B 86 D F6 2F 60 20 F4 86 E C6 1 20 EE
2F30 86 14 C6 1 20 E8 86 D F6 2F 60 8D B F6 2F 60
2F40 8D 6 86 20 C6 5 20 D6 34 15 BD 80 F 35 15 5A
2F50 26 F6 39 86 34 B7 FF 21 1C EF 20 C4 0 0 0 0
2F60 F1 D1 D5 D5 F5 F5 F5 F5 F5 F5 F5 F5 F5 F5 F5 F5
```

DRAGON OPEN FILE

Send us your Dragon programs, beginning with a general description and then explaining how the program is constructed. Take care that the listings are all bug free, enclosing a cassette and, if possible, a printout. We pay £6 for each original bug-free program published, double for the program of the month. If you have any problems with the listings, please send your queries to the appropriate author, *Dragon User*, 12-13 Little Newport Street, London WC2H 7PP.

Brick

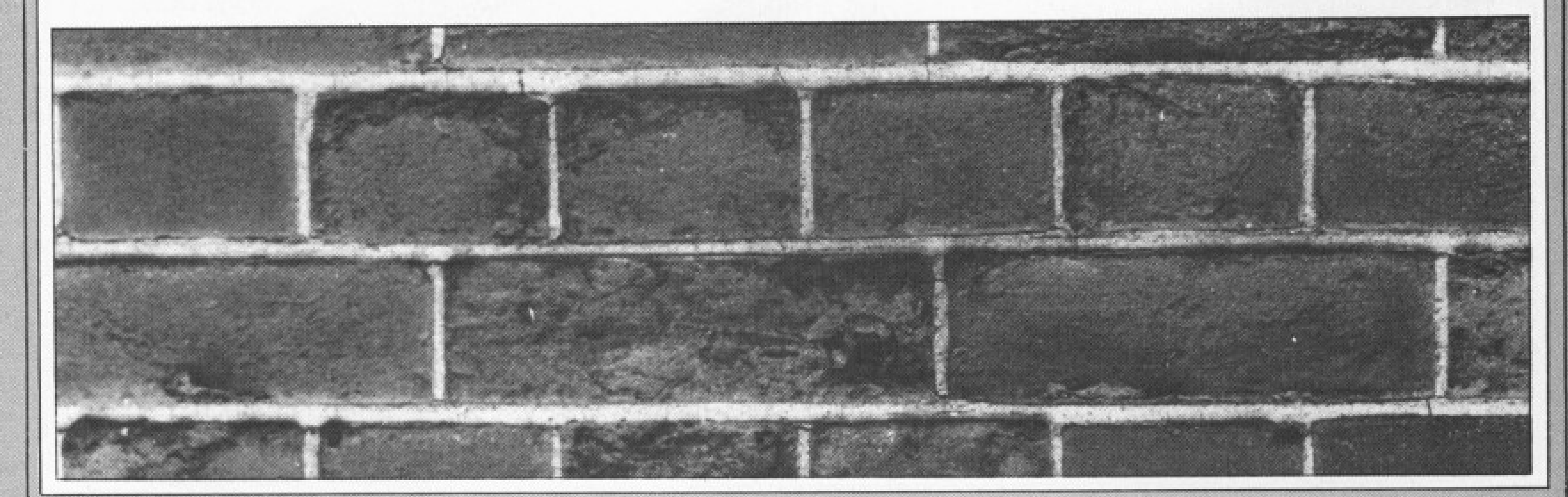
From Iolo ap Gwynn in Aberystwyth

BRICK is yet another version of an old favourite, which seems to originate in a certain orchard. In this one the bat is mobile in two directions and a degree of skill is required in order to master this game. A word of warning though, it can be mildly addictive. Apart from asking for another game, all control is by means of the right-hand joystick and its fire button.

All of the game is played between lines 250 and 460. Directions of travel after a rebound is determined by a set of sub-routines, lines 580-630, which are called according to the flag set in line 270.

Should you stop the game by pressing the "BREAK" key then be sure to press the RESET button before you attempt to load or save from tape because the I/O is upset by the higher speed set in line 10.

```
10 POKE &HFFD7,0:' SET HIGH SPEED
20 CLS4: RE=0
30 PRINT@(3*32)+10,"BRICK-WALL"
40 PRINT@(5*32)+5,"TO PLAY THIS GAME YOU WILL  NEED TO PLUG
   IN A JOYSTICK       CONTROL INTO THE
   RH SOCKET"
50 PRINT@(7*32)+5,"THE MOVEMENT OF THE BAT IS
   CONTROLLED BY THE VERTICAL
   MOVEMENT OF THE JOYSTICK"
60 PRINT@(15*32),"c I AP GWYNN 1983"
70 FOR I=0 TO 10000:NEXT
80 CLS3:DU=JOYSTK(0):BF=INT(JOYSTK(1)/4)*32:DU=JOYSTK
   (2):DU=JOYSTK(3)
90 PRINT@(8*32)+3,"PRESS BUTTON TO START GAME"
100 IF PEEK(65280)=126 OR PEEK(65280)=254 THEN GOSUB 470
   ELSE GOTO 90
110 SC=0
120 ' START BALL
130 ST=RND(14):DI=0
140 PC=(ST*32)+22:FL=3+RND(3)
150 POKE 1024+PC,128
160 GOSUB 250
170 CLS8
180 PRINT@(5*32)+5,"YOUR SCORE WAS ";SC
190 IF SC>RE THEN PRINT@(8*32)+5,"THIS IS A RECORD!!"
   :RE=SC:FOR I=0 TO 20:SOUND 100,2:NEXT I
200 PRINT@(10*32)+5,"ANOTHER GAME Y/N.?";
210 D$=INKEY$:IF D$="" THEN 200
220 IF D$="Y" THEN 80
230 POKE &HFFD6,0:' RESET SPEED TO NORMAL
240 END
250 IF 1024+PC<1024 OR 1024+PC>1535 THEN RETURN ELSE
   DU=JOYSTK(0):BN=(INT(JOYSTK(1)/4)*32)+INT(D
   U/3):DU=JOYSTK(2):DU=JOYSTK(3)
260 POKE 1024+BP,143:BP=BN:POKE 1024+BP,149
270 ON FL GOSUB 580,590,600,610,620,630
280 IF DI=0 THEN 390
290 IF PEEK(1024+PN)=201 THEN SC=SC+1:SOUND 100,2:GOTO 360
300 IF PN>0 AND PN<31 THEN FL=3:GOTO 350
310 IF PN>15*32 AND PN<(15*32)+31 THEN FL=1:GOTO 350
320 FOR X=31 TO 511 STEP 32
330 IF PN=X THEN 370
340 NEXT X
350 POKE 1024+PC,143:PC=PN:POKE 1024+PC,128:GOTO 250
360 POKE 1024+PC,143:PC=PN:POKE 1024+PC,128
370 FL=3+RND(3):DI=0
380 GOTO 250
390 IF PEEK(1024+PN)=201 THEN SC=SC+1:SOUND 100,2:GOTO 460
400 IF PN>0 AND PN<31 THEN FL=4:GOTO 450
410 IF PN>15*32 AND PN<(15*32)+31 THEN FL=6:GOTO 450
420 IF PEEK(1024+PN)=149 THEN FL=2:DI=1:SOUND 83,2:GOTO250
430 FOR Y=0 TO 15
440 IF PN=Y*32 THEN RETURN ELSE NEXT Y
450 POKE 1024+PC,143:PC=PN:POKE 1024+PC,128:GOTO 250
460 POKE 1024+PC,143:PC=PN:POKE 1024+PC,128:GOTO 400
470 ' DRAW FIELD
480 CLS
490 FOR I=0 TO 15
500 POKE 1024+(I*32)+23,201
510 POKE 1024+(I*32)+25,201
520 POKE 1024+(I*32)+27,201
530 POKE 1024+(I*32)+29,201
540 POKE 1024+(I*32)+31,201
550 NEXT I
560 RETURN
570 ' DIRECTIONS
580 PN=PC-31:RETURN
590 PN=PC+1 :RETURN
600 PN=PC+33:RETURN
610 PN=PC+31:RETURN
620 PN=PC-1 :RETURN
630 PN=PC-33:RETURN
```



Mantukan Pyramid

From A. Daniel in Sevenoaks

THE MANTUKAN PYRAMID is a game which sets an interesting puzzle to determine how to achieve the highest possible score. Try the game first at about level 3 to get the idea and then try some of the deeper levels (for example 20 or 30).

The score is made up of treasure points, a screen bonus and a time bonus and you have to contend with a man-eating Mantukan bat and a limited supply of fresh air.

There are rem lines, instructions and various methods of play as well as a tape saving routine, but to make it all as clear as possible here are a few extra notes.

The essential lines of the program are 30-1180 followed by 1340-1770 which determine the type of game and the final score. The remainder are sound effects, title page and detailed instructions.

The Pyramid scoring sequence may be tested on its own by temporarily writing GOTO 700 instead of the rem in line 80.

The variable MT (line 150) gives the amount of air available. BB and B relate to the level of play. Line 560 determines the number of treasure points you can pick up and this is related to the level of play. It takes some working out but is meant to be subtle. The time bonus is created by MC (line 1570) and the formula in line 1670. You can easily get a negative time bonus but if you don't like this then increase the value of MC.

You may go over a treasure square several times but as you leave a black trail behind you, you may lose track of where you are and get eaten by the spider. The movements of the spider are deliberately made fairly predictable to make avoiding it a matter of skill and not luck.

It would, I think, take another computer program to work out which level of play is likely to produce the highest scores, bearing in mind that you must reach the summit of the pyramid to earn the bonuses so the best thing you can do is to start playing the game.

To save your typing on tape turn on the recorder and type RUN10000. You can save up to four times.

```
10 GOSUB1850: ' TITLE SEQUENCE - THE MAN
TUKAN PYRAMID - BY A. DANIEL (13/12/84)
20 ' INTIAL VALUES
30 DIMSF(10),SG(10),HT(512)
40 FOR F=1 TO 8
50 READ SF(F),SG(F)
60 NEXT F
70 SP=480
80 ' TO TEST SCORE PYRAMID TYPE THIS LIN
E AS GOTO700
90 GOSUB1190
100 ' NEW GAME SEQUENCE
110 GOSUB1340
120 TIMER=0
130 ' MAIN SEQUENCE
140 CLS:X=511: SD=0: TT=-500: N1=100
150 MT=6000/B: IF MT>555 THEN MT=555
160 K1=RND(8)
170 K2=RND(8): IF K2=K1 THEN 170
180 K3=RND(8): IF K3=K2 OR K3=K1 THEN 18
0
190 FOR A=1 TO 510
200 F=RND(B): IF F>3 THEN F=3
210 IF F=1 THEN K4=K1*16
220 IF F=2 THEN K4=K2*16
230 IF F=3 THEN K4=K3*16
240 HT(A)=F
250 PRINT@A,CHR$(127+K4);
260 NEXT
270 ' PLAY SEQUENCE
280 POKE1024+X,128
290 MT=MT-1
300 PRINT@480,INT(MT);
310 IF MT<0 THEN CLS: PRINT:PRINT:PRINT"
THE AIR HAS BECOME POISONOUS": PRINT"STA
RT AGAIN": FOR J=1 TO 5000: NEXT: GOTO14
0
320 IF HT(X)=3 THEN SD=SD-1
330 IF HT(X)=2 THEN GOSUB550
340 IF X=511 THEN SD=SD-1
350 IF PEEK(344)=223 THEN X=X+1: GOSUB51
0: BH=0
360 IF PEEK(343)=223 THEN X=X-1: GOSUB51
0: BH=0
370 IF PEEK(342)=223 THEN X=X+32: GOSUB5
10:BH=0
380 IF PEEK(341)=223 THEN X=X-32: GOSUB5
10: BH=0
390 ' THE MANTUKAN BAT SEQUENCE
400 POKE1024+Y,W: Y=Y-RND(20): IF Y<1 TH
EN Y=510
410 W=PEEK(1024+Y): PRINT@Y,"W";
420 IF X=0 THEN PRINT@X,"*";: GOTO430 EL
SE 440
430 IF ZX=1 THEN 590 ELSE 650
440 IF X=Y THEN CLS0: PRINT@99,"YOU ARE
IN THE MANTUKAN BAT'S BELLY, SO YOU HAD
BETTER START AGAIN";:PLAY"ET4EET2ET4GF#F
#EED#T2E":GOTO 140:ELSE 460
450 PLAY"ET4P60EP60T8ET2P60ET4GF#F#EED#T
2E"
460 N=SD+N1: IF N<2 THEN N1=N1+100: GOTO
460
470 IF N>254 THEN N1=N1-100: GOTO460
480 IF BN<>N THEN 490 ELSE 270
490 SOUNDN,1: BN=N
500 GOTO270
510 ' POINT ADDING SEQUENCE
520 IF X<0 THEN X=X+32: GOTO520
530 IF X>511 THEN X=X-32: GOTO530
540 RETURN
550 BH=BH+1
560 IF BH>RND(20) THEN A=-1 ELSE A=RND(I
NT(B/10)+1)
570 SD=SD+A
580 RETURN
590 FOR X=0 TO 63 STEP2
600 FOR Y=0 TO 31 STEP2
610 IF POINT(X,Y)=K2 THEN CLS:PRINT:PRIN
T: PRINT"YOU CHEATED - THERE'S A TREASUR
E  SQUARE LEFT SO GO BACK TO THE   START
": FOR J=1 TO 5000: NEXT: GOTO140
620 NEXT Y
630 NEXT X
640 GOTO660
650 FOR GG=1 TO 1000: NEXT
660 GOSUB740
670 IF ZZ=1 THEN ZZ=0: GOTO100
680 FOR JJ=1 TO 2000: NEXT
690 GOSUB1480: GOTO140
700 ' SCORE TEST
710 SD=300
720 GOSUB740
730 SD=20: GOTO720
740 ' SCORING SEQUENCE
750 CLS3
760 FOR G=352 TO 511
770 POKE1024+G,159
780 NEXT
790 NX=78: PX=2
800 FOR LX=1 TO 14
810 FOR MX=NX TO (NX+PX)
```

Continued on page 31



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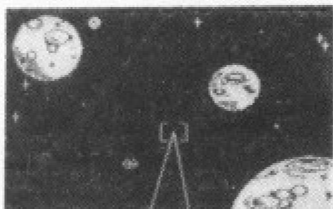
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I want to wish your company the very best with this cassette, it deserves to be a No. 1 seller.

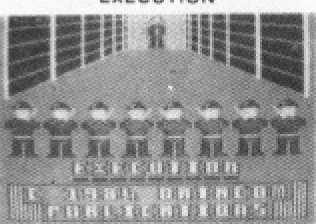
Yours sincerely
Mr C Davis
W. Midlands

INTERPLANETARY TRADER



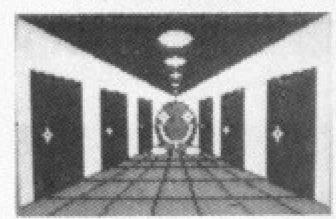
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EXECUTION



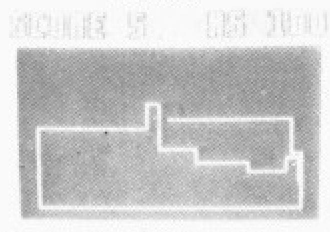
Are you cool, level headed? You need nerves of steel to play EXECUTION. Standing before the awesome firing squad you realise this is your last chance to receive a pardon, but time is fast running out. Features full high res moving graphics and sound. Hours of fun guaranteed in this massive 30K game.

WUMPUS MANSION



Only a crazy person would go near WUMPUS MANSION. You however, have ventured INSIDE it!!! Tempted by hoards of priceless treasures your mission is to raid the mansion and leave through the maze of tunnels. Will you outwit the dreaded WUMPI?? Can you avoid the time bombs?? Incredible fun!! Uses 29K.

WIPEOUT



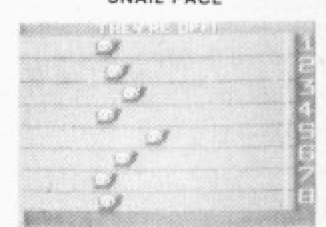
BE WARNED - THIS IS NOT EASY!!
A challenging multilevel graphic game demanding fast, accurate reaction. It begins easily enough, but gets progressively more difficult. Features 4 colour high resolution graphics, sound, bonus points and high score.

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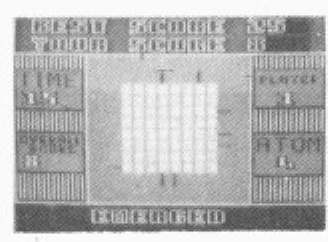
Is it skill or luck? Can you turn your humble £50 stake into £1,000,000?? This simple yet highly compelling game supported by excellent colour graphics and brilliant sound effects. Over 20K of clever programming!

SNAIL PACE



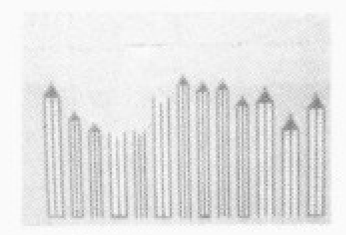
The excitement is almost unbearable as you watch 1-8 'thoroughbred racing snails' thrash it out on the racecourse!! Game features sensible odds and form guide to assist you. This superb piece of complex programming supported by magnificent graphics will ensure hours of excitement. A massive 26K!!

ATOM HUNT



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```
820 POKE1024+MX,128
830 NEXT MX
840 NX=NX+31: PX=PX+2
850 NEXT LX
860 SD=SD+SQ
870 SN=480-INT(SD/32)*32:
880 IF SN=SP THEN SL=SP: GOTO920
890 IF SN<SP THEN SH=-32 ELSE SH=32
900 IF SH>0 THEN RE=0
910 FOR SL=SP TO SN STEP SH
920 SE=SL+15: IF SE>495 THEN SE=495
930 FOR F=1 TO 8
940 POKE1024+SE-SF(F),SG(F)
950 NEXT F
960 FOR GG=1 TO 200: NEXT
970 IF SL=SN THEN PRINT@0,"SCORE ";SD;
980 IF SL<89 THEN PRINT@0,"SCORE-";SD;:P
RINT@450,"WELL DONE! YOU HAVE REACHED";:
PRINT@492,"THE TOP";: FOR GG=1 TO 1000:
NEXT: GOTO 1620
990 IF (495-SD)>(SE+6) THEN GOSUB1130: G
OTO1100
1000 IF (495-SD)<(SE-6) THEN POKE990+SE,
220:POKE958+SE,210:SOUND89+RE,1
1010 FOR GG=1 TO 200: NEXT
1020 IF (495-SD)<(SE-12) THEN POKE1023+S
E,200: POKE1022+SE,204:SOUND101+RE,1
1030 FOR GG=1 TO 200: NEXT
1040 IF (495-SD)<(SE-18) THEN POKE993+SE
,220: POKE961+SE,209:SOUND97+RE,1
1050 FOR GG=1 TO 200: NEXT
1060 IF (495-SD)<(SE-24) THEN POKE1024+S
E,196: POKE1025+SE,204:SOUND105+RE,1
1070 FOR GG=1 TO 200: NEXT
1080 IF (495-SD)<(SE-31) THEN GOSUB1130
1090 IF SN=SP THEN 1110
1100 RE=RE+8:NEXT SL
1110 SP=SN: FOR GG=1 TO 500: NEXT
1120 SQ=SD:RETURN
1130 FOR SM=1 TO 4
1140 POKE1021+SE+SM,128
1150 POKE989+SE+SM,128
1160 POKE957+SE+SM,128
1170 NEXT
1180 RETURN
1190 ' INSTRUCTIONS
1200 CLS: PRINTTAB(5)"YOU ARE EXPLORING
INSIDE   THE MIGHTY MYSTERY PYRAMID OF
 MANTUKAN. IT IS DECORATED IN 3  MAGIC C
OLOURS, WHICH VARY FROM  ";
1210 PRINT"LEVEL TO LEVEL. ONE COLOUR IS
   CURSED BY THE ANCIENT KINGS (YOULOSE
POINTS); A 2ND COLOUR HAS  THE PEACE OF
THE GODS (NO SCORE HERE); AND ON THE 3RD
 COLOUR YOU ";
1220 PRINTTAB(0)"CAN COLLECT TREASURE -
BUT TAKE CARE, FOR THE CURSE MAY STILL
BREAK THROUGH IF YOU SPEND TOO  LONG THE
RE."
1230 PRINT:PRINT:PRINT"PRESS ANY KEY TO
CONTINUE";
1240 IF INKEY$="" THEN 1240
1250 CLS: PRINTTAB(5)"EXPLORE USING ARRO
W KEYS   FROM BOTTOM RIGHT TO TOP LEFT:
 THEN SEE IF YOU HAVE REACHED THETOP OF
THE PYRAMID. THE DEEPER  THE LEVEL YOU S
TART AT THE MORE DIFFICULT IT IS TO SCOR
E POINTS AND REACH THE TOP."
1260 PRINTTAB(5)"BEWARE OF RUNNING OUT O
F   AIR (AMOUNT IS PRINTED LOWER    LEFT
). BEWARE ALSO THE DREADED  MANTUKAN BAT
 -IF HE LANDS ON YOUHE WILL SWALLOW YOU
WHOLE."
1270 PRINT:PRINT:PRINT"PRESS ANY KEY TO
CONTINUE";
1280 IF INKEY$="" THEN 1280
1290 CLS: PRINTTAB(4)"A RISING MUSICAL S
CALE MEANSYOU ARE GAINING POINTS AND VIC
E VERSA. WHEN YOU HAVE COLLECTED  SUFFIC
IENT TREASURE POINTS YOU  WILL REACH THE
 PINNACLE OF THE  PYRAMID."
1300 PRINTTAB(4)"THE CHALLENGE OF THE GA
ME ISTO FIND THE DEEPEST LEVEL OF    EXP
LORATION FROM WHICH YOU CAN  STILL REACH
 THE TOP IN ONE OR   MORE GOES."
1310 PRINT:PRINT:PRINT"PRESS ANY KEY TO
CONTINUE";
1320 IF INKEY$="" THEN 1320
1330 RETURN
1340 ' LEVELS OF PLAY
1350 CLS:PRINT"WHAT LEVEL WILL YOU EXPLO
RE"
1360 PRINT"0=EASY - 100=IMPOSSIBLE"
1370 INPUTBB
1380 CLS
1390 PRINT"DO YOU WANT TO PLAY ON:-"
1400 PRINT"A CONSTANT LEVEL":PRINT"ENTER
   1"
1410 PRINT"A RANDOM LEVEL BETWEEN 0 AND
THELEVEL ENTERED ABOVE":PRINT"ENTER
2"
1420 PRINT"A PROGRESSIVELY EASIER LEVEL"
:PRINT"ENTER       3"
1430 PRINT"AN INCREASINGLY DIFFICULT LEV
EL":PRINT"ENTER          4"
1440 PRINT"(SCORE BONUS= 10*LEVEL OF PLA
Y -";
1450 PRINT"DEEPER LEVELS HAVE MORE VALUA
BLETREASURE BUT THERE IS MUCH LESS OF IT
)"
1460 INPUTAA: IF AA<1 OR AA>4 THEN 1460
1470 A1=1
1480 ON AA GOTO1490,1500,1510,1530
1490 B=BB+3: GOTO1550
1500 B=RND(BB+1)+3: GOTO1550
1510 IF BB<8 THEN BE=1 ELSE BE=5
1520 B=BB: BB=BB-BE: IF B<3 THEN B=3:BB=
3: GOTO1550
1530 IF BB>4 THEN BE=5 ELSE BE=1
1540 B=BB: BB=BB+BE: IF B<3 THEN B=3: BB
=4
1550 IF A1=1 THEN A1=0: GOTO 1560: ELSE
1590
1560 CLS: PRINT:PRINT:PRINT:PRINT" IF YO
U WANT A REALLY HARD GAME IN WHICH YOU H
AVE TO VISIT ALL  THE TREASURE SQUARES T
O QUALIFY ENTER '1'": PRINT" EXTRA TIME
POINTS ALLOWED FOR  THIS TYPE OF GAME"
1570 INPUT ZX: IF ZX=1 THEN MC=60000 ELS
E MC=40000
1580 AB$="GOOD LUCK": GOSUB1780
1590 TD=TD+B*10
1600 RETURN
1610 DATA0,197,1,202,31,221,32,223,33,22
3,34,222,64,194,65,193
1620 ' SCORE TOTALS
1630 SQ=SD
```

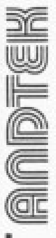
Continued on page 33

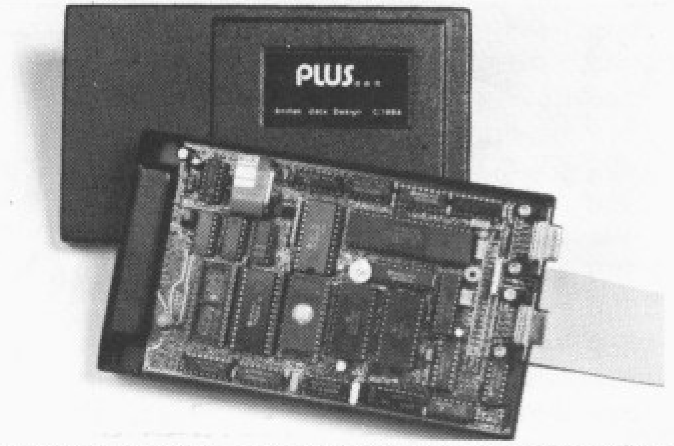

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```
1640 IF A2=1 THEN TD=0
1650 CLS2: PRINT@96,"SCORE            "; SQ
1660 PRINT"SCREEN BONUS      ";TD
1670 MB=INT((MC-TIMER)/20)
1680 IF A2=1 THEN A2=0: MB=0
1690 PRINT"TIME BONUS        ";MB
1700 TT=SD+TD+MB
1710 PRINT"TOTAL             ";TT
1720 GOSUB1830
1730 PRINT:PRINT"PRESS CLEAR FOR ANOTHER
 GAME"
1740 HA$=INKEY$: IF HA$="" THEN 1740
1750 IF HA$=CHR$(12) THEN 1760 ELSE 1740
1760 SQ=0: TD=0: MB=0: TT=0: ZZ=1: SP=48
0: RE=0
1770 RETURN
1780 ' ADDITIONAL INSTRUCTIONS
1790 CLS8:PRINT@32,"      SCREEN BONUS IS
 WORTH MOST POINTS; THEN THERE IS A TIME
     BONUS WHICH CAN COUNT AGAINST   YOU
IF YOU SPEND TOO LONG. YOU  CANNOT GET A
 SCREEN BONUS UNLESS";
1800 PRINT"YOU REACH THE TOP OF THE PYRA
MID"
1810 '
1820 PRINT@298,AB$;
1830 PLAY"T8BO4CDO3BO4CO3ABGAF#T4GBT7DP6
T8O4CDECDO3BO4CO3ABGT4F#AT7DP6T8EF#GDEF#
GEF#G#AEF#G#AG#ABO4CO3BO4CDECO3AF#GDGBT4
G"
1840 RETURN
1850 A$="U6E2R2F2D6U4L6"
1860 D$="U8L1R5F1D6G1L5"
1870 E$="U8R5L5D4R4L4D4R5"
1880 H$="U8D4R6U4D8"
1890 I$="BR3R2L1U8R1L2"
1900 K$="U8D5E5G4F4"
1910 M$="U8F3E3D8"
1920 N$="U8D1F6D1U8"
1930 P$="U8R6D4L6"
1940 R$="U8R5F1D2G1L5R1D1F4"
1950 T$="BU8R6L3D8"
1960 U$="BU1U7BR6D7G1L4H1"
1970 Y$="BU8F3D5U5E3"
1980 PMODE3,1:SCREEN1,0:PCLS2
1990 DRAW"S15;C1;BM85,40;"+T$:DRAW"BM115
,40;"+H$:DRAW"BM145,40"+E$
2000 DRAW"BM25,80;"+M$:DRAW"BM55,80;"+A$
:DRAW"BM85,80;"+T$:DRAW"BM115,80;"+U$:DR
AW"BM145,80;"+K$:DRAW"BM175,80;"+A$:DRAW
"BM205,80;"+N$
2010 DRAW"S4;C4BM77,140;E50F50L100"
2020 PAINT(110,120),4,4
2030 DRAW"S15;C1;BM25,180;"+P$:DRAW"BM55
,180;"+Y$:DRAW"BM85,180;"+R$:DRAW"BM115,
180;"+A$:DRAW"BM150,180;"+M$:DRAW"BM175,
180;"+I$:DRAW"BM205,180;"+D$
2040 FOR U=1 TO 1000:NEXT
2050 RETURN
10000 FOR AH=1 TO 10000: NEXTAH
10010 FOR AZ= 1 TO 4
10020 CLS3:PRINTAZ: CSAVE "PYRAMID"
10030 MOTOR ON:CLS4
10040 IF AZ=4 THEN STOP
10050 FOR AJ=1 TO 3000: NEXTAJ
10060 NEXT AZ
```

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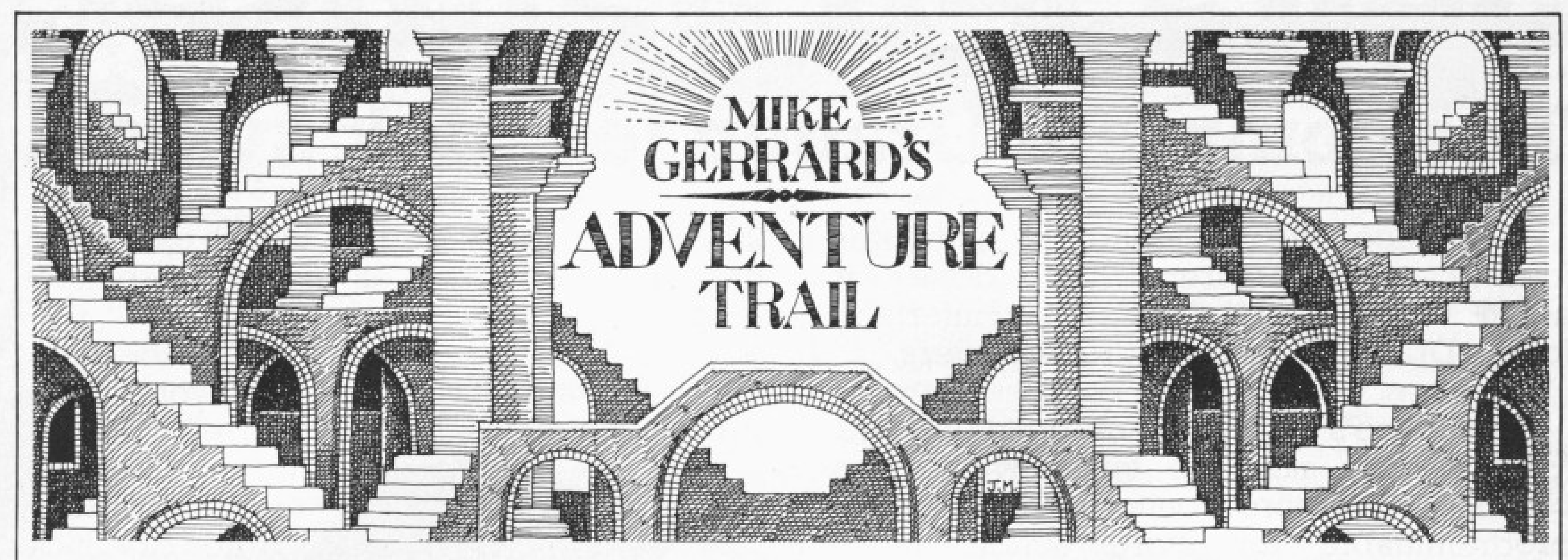
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WHEN I WAS in Wigan at Christmas I noticed a distinct lack of Samurai around the town, but that doesn't stop a company from calling itself Samurai Software. If you send £7.95 to their offices at 4/6 Library Street, Wigan, you will receive in return a copy of their adventure, *Castle of the Skull Lord*, along with a free Dragon dust cover, which is a generous additional touch. I wish I could be equally generous about the adventure, but your ruthless reviewer has to be honest and say it's not the best he has ever seen.

The Skull Lord is a necromancer, who once attacked and defeated a race of noble dwarves, and now it's your duty to get into the Skull Lord's castle and retrieve a fabled crown for the dwarves, which was among the treasure stolen by the evil Skull Lord. The game is text-only, as are all the adventures this month, and accepts the usual two-word commands. For some reason there is no SAVE routine, which is a glaring omission as the BASIC program leaves quite a chunk of memory to play with in the Dragon. Once you've worked out the solutions to the first few problems, you don't want to continually go through them every time you load the tape, or encounter an unexpected death while you're playing.

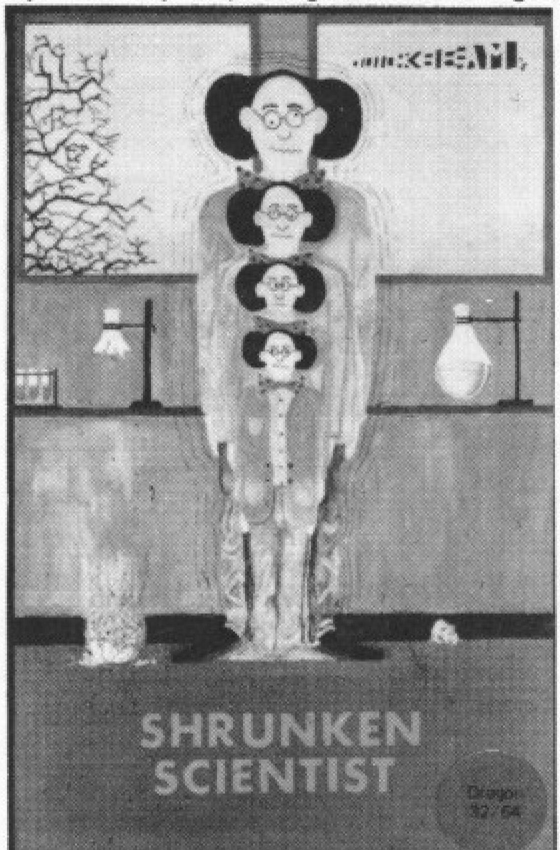
The game begins with you on a barren plain, signs of war visible all around you, as indeed are exits, and you can also see a saw. Head north and there's a withered tree, and if you SAW TREE (having first taken the precaution of climbing it) you miraculously produce a stump and an oar! Amazing stuff. I'd have expected a stump and a felled tree, myself, but this is not an adventure for the realist.

Armed with an oar, you seek a boat and, having found one, you discover the limitations of the inputs allowed for in the program. Type ROW or ROW SOUTH (you're on the north bank of a river) and you're told "You can't do that yet," which is misleading as the command which works is ROW BOAT. The word "Yet" implies you need another object or to perform another task, not simply that the command is wrong.

Other examples of careless programming include a sequence in the mountains where your progress is blocked by an avalanche, and having found a spade to DIG SNOW, the avalanche reappears every time you pass the location. The need for a SAVE routine is emphasised by the fact that if you reach the castle entrance hall and go WEST, you find "You are in a cell. There are no exits but the south wall looks very unstable". Ignoring the question of how you suddenly got in there if there are no exits, and that you shouldn't be imprisoned without warning, you obviously need a SAVE routine to experiment with problems like that. The tasks aren't difficult, and even with a free dust cover I can't really recommend this one.

Nor am I wildly enthusiastic about *Franklin in Wonderland* from Salamander, the first of what would have been a trilogy had the company not decided the Dragon adventure market was too risky. As it is, *Franklin in Wonderland* is available for just a fiver, without cover and instructions, but including the plastic wallet the cassette comes in. Before I go ahead with my grouchy comments, bear in mind that I didn't think much of Dan Diamond either, which I know puts me in a minority as far as Dragon adventurers go.

My major complaint is that whichever way you go at the start, you are in a maze, with no way of plotting a route through.



Drop your sweeties and that's the last you'll see of them. The first time I played I got through by fluke, and didn't bother saving a game so I could start beyond the maze, but several times after that I spent a fruitless 10 minutes at the keyboard travelling around, seeing the same location description literally hundreds of times, before giving up in frustration. Breaking into the program (it's in BASIC and unprotected) showed that there seems to be a random element at play in this first location, dictating whether you're able to get out of it or not. I'm prepared to be corrected on that, as it's hard to be certain without a full program listing, but it's not my idea of adventure playing.

Getting into the game has you falling down a deep dark hole into Wonderland, leading to illogical encounters with the Mad Hatter, March Hare, Cheshire Cat and so on. But, I was disappointed with this, and with Salamander's other "no-frills" adventure, *White Cliffs*, which gave me an OUT OF MEMORY error when loaded. That's taking no-frills too far!

Best of this month's batch (which isn't difficult) is *The Shrunken Scientist*, a bargain at £5.95 from a company new to me, Quickbeam Software, of 67 Old Nazeing Road, Broxbourne, Herts EN10 6RN. The title sets the story, as due to a slip-up in your lab you find yourself only one-inch tall, only able to regain your full height by getting to the top of the lab table and eating some of the crystals that are there. If being shrunken in size teaches you nothing else, it shows you what an untidy slob you are around the lab. On your travels you find rusty screws, bits of walnut shell, darning needles, even fingernails. I'd sack the cleaner myself. Great fun is had with the new perspective you've got: puddles become lakes, insects become monsters (and there are plenty of those, though DDT works wonders).

I've been having great fun with this adventure, discovering how to deal with the spider, the frog, and how to get out onto the window ledge without becoming a raven's breakfast, but I haven't yet figured out how to avoid compostitis to enable me to get at the shirt button safely. The game has glaring faults, like no SAVE feature and sound effects which lock the machine forcing you to RESET (this happens in two places), but despite that it's enjoyable. ■

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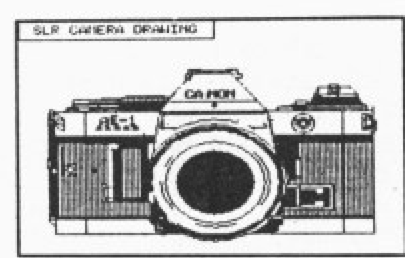
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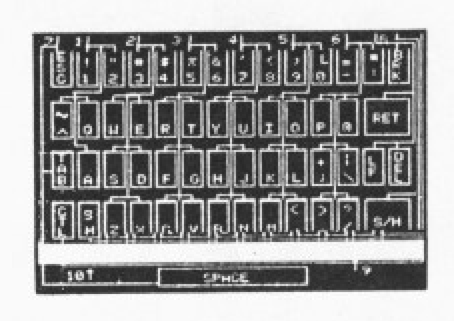
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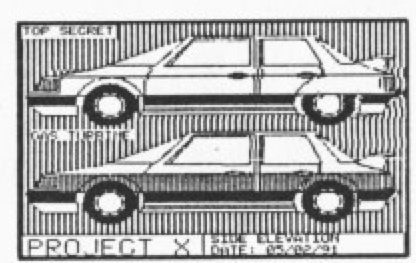
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Bookbytes

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Book: *The Penguin Book of Personal Computing*
Author: *John Graham*
Publisher: *Penguin*
Price: £3.95

THIS WILL be a very short review — this book is absolutely superb and I really have no faults to point out. Not written for the ignoramus, it will, however, provide the educated reader with the ideal introduction to computing up to a standard somewhere around that of O-level Computer Science (the syllabus of which assumes that its student does not own a computer).

Within its pages are covered the development of the micro and personal computer, computer architecture, I/O, program development, programming languages, software, networking, system selection and a comprehensive contents list, Index, and five appendices, as well as a list of every illustration.

The computer book has matured and come down in price. Three years ago, had a book of this quality been available, it would have cost many more pounds than this excellent tome. The author is an experienced ICL programmer, and it shows! His text is precise, well written, and very well documented.

This book stands proud upon my bookshelf. I have nothing more to say.

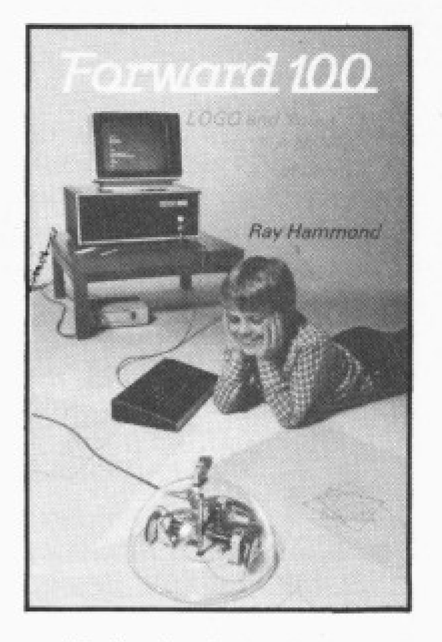
Jason Orbaum

Book: *Forward 100*
Author: *Ray Hammond*
Publisher: *Viking*
Price: *£12.95*

MUCH HAS been said in the media recently about the turtle-graphics based language LOGO — the successor to Basic and Pascal in the "every-computer-should-provide-it-as-standard" argument. This book does not set out to continue the argument, nor does it try to teach the LOGO language, rather it sets out to explain what all the fuss is about. Hammond suggests that LOGO has tremendous value in the educational field because it teaches children to think logically and creatively, whilst at the same time being fun. The theme of the book is neatly explained by Hammond in the first chapter:

"It is easy to motivate a child to learn LOGO; the problem is to explain its importance to adults."

The point of LOGO, according to the author, is not the syntax and power of the language itself, but the new approach to education that it allows. Hammond sees it as paving the way for an education revolution:



"Schools of the future will be centres of exploration with computers and databases providing information. Teachers will become guides rather than instructors."

If all this sounds mind-numbingly boring, well,it isn't. The author's obvious enthusiasm for the subject is infectious, and I found it hard to put the book down. Although at £12.50 it's rather expensive to buy, it's definitely worth going to your local library and ordering a copy.

David Rowntree

Book: *FORTH for Micros*
Author: *Steve Oakey*
Publisher: *Newnes*
Price: *£6.50*

BY NOW, every Dragon user must be aware that he or she is not stuck with the limitations of Basic as supplied with the machine. If program speed is the problem, the solution is either to buy a Basic compiler, or use another language altogether. Assembly language, the fastest of all, is very fiddly to use and debug, so many people turn to intermediate languages like FORTH.

FORTH for Micros attempts to teach the language to those with programming experience in either Basic or Pascal, and points out that it is not an introduction to the subject of programming itself.

The book starts by introducing concepts such as stacks and reverse polish notation (the mathematical notation used by FORTH), and quickly moves on to simple programs. The early examples are given in Basic, Pascal and FORTH to make it easier to see what's going on. All of the usual topics are then introduced: selection statements; looping constructs; arithmetic; data types; input/output, ending up with a look at implementing large programs. The example programs shown include a multi-dimensional array implementor — a facility not available in standard FORTH. At the end of each chapter there are a selection of self-test exercises.

FORTH for Micros is a well written book that covers the main points of the language in an easy style, but there are a lot of FORTH tutors on the market about which one could say the same thing. There is nothing that makes this book stand head and shoulders above the rest.

David Rowntree

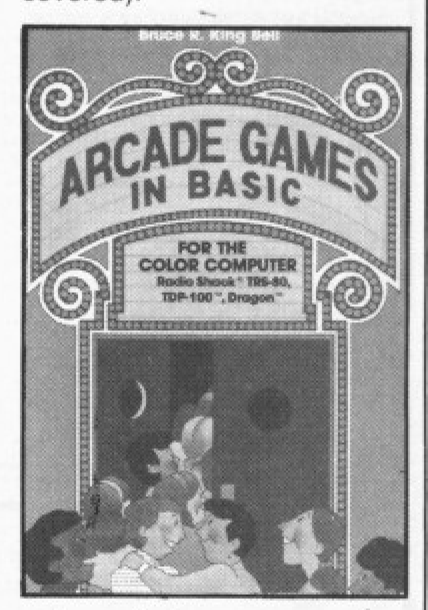
Book: *Arcade Games in BASIC*
Author: *Bruce King Bell*
Publisher: *Reston*
Price: £14.95

THIS IS a thinly disguised "15 super games for your . . ." type of book. Not much more need be said. If this is your type of book, then this one is excellent in its field offering competent versions of Breakout, Snake, Scramble (which has machine code in it — a fact which makes the title of the book somewhat dubious!), et al.

The programs are of a standard slightly above those you would find in computer magazines and they are very well documented, but almost every one relies on the speed poke for one reason or another, and they are in BASIC, which is not a good language for arcade games.

The book is well written and I was pleased to see that it does not talk down to its readers. It credits its reader with a fair amount of intelligence at times, although the game introductions leave a lot to be desired, eg: "Nobody remembers why the war began. All that is known is that in the nuclear age the earth has quickly become war ravaged." All it needs is an "It was cold, too cold", and it will be a best seller!

The book's appendices are fairly competent and complete, giving Color Basic versions of the games for those with a Co-Co and no Extended Basic Cartridge (the Dragon comes with Extended Basic as standard), an "Index" of the major tutorial topics covered in each chapter, ie keyboard rollover table, joystick zoning and the like, and a final appendix of useful pokes and peeks not all of which seem to work (this could be because the book was quite obviously written for a Co-Co and re-covered).



Overall then, a superior member of an inferior genre of book, but, as I have said, if the "Zap Pow and Bang with 30 games for your . . ." is your scene, then this is your book. And if not, it may still be worth a look by programmers as it does present some great examples of good programming (emphasis is on the word good, for the programs, by task definition, are not structured!).

Jason Orbaum

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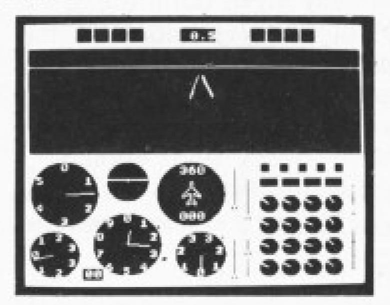
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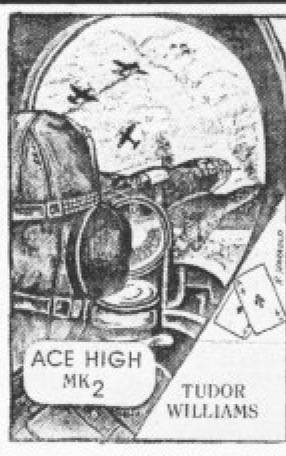
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Dragon Answers

Switching to map 1

I HAVE an awkward question which I hope you can answer. I recently acquired a copy of a program (quite accidentally) which has the capability of switching to map1 and copying whatever you want into the upper 16K of RAM. Since I have been toying with the idea of reassembling the Basic to get rid of the bugs and improve its capabilities, I found this interesting and, although I haven't solved all the problems, one particular piece of the puzzle is still evasive.

A great deal of information was provided by the article in the January issue about map type 1. My question is — Under map type one does the SAM chip still access the interrupt vectors from \$BFFO–BFFF or are they mapped from \$FEFO–FEFF or do they revert to \$FFFO–FFFF?

Robin Telkman
18 Arksey Terrace
Leeds

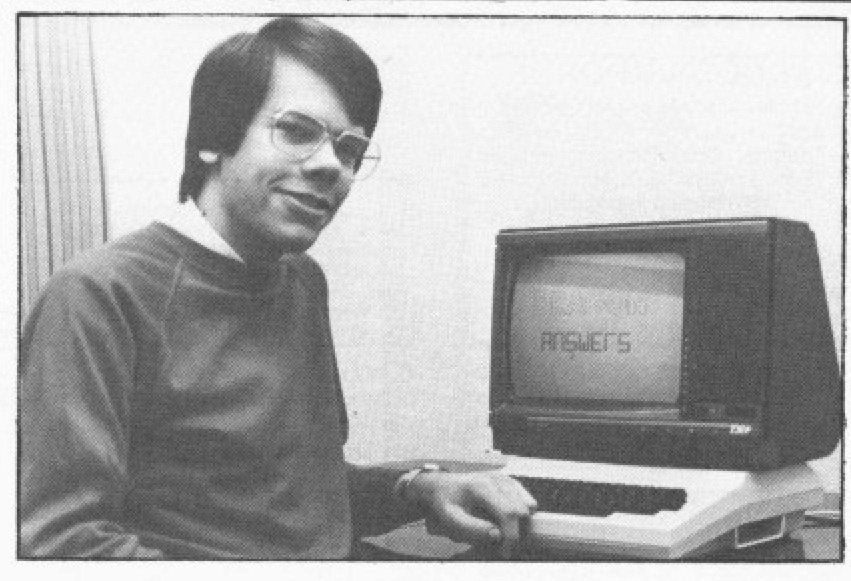
THE DRAGON'S hardware is permanently configured so that the 6809 reads the contents of locations BFF2 to BFFF of the ROM for the interrupt and reset vectors, no matter whether you are in map 0 (ROM) or map 1 (RAM). Don't forget, however, that these interrupts have vectors which themselves point at vectors in RAM between 256 and 273 which you can change yourself.

Negative offset -a complement

WHEN USING the CLOADM command, it is possible to relocate your m/c program at a different address by using an offset. This is all well and good, but how do you get around the problem of relocating to a lower address? I have tried entering a negative integer, but the only result is an F/C error.

Bill Lees
29 Athlone Ave
Bury
Lancs

THIS PROBLEM with the CLOADM command comes up frequently, and is worth another mention. To achieve a negative offset you need to give the two's complement value of the negative number. That is 65536-N.



So, to do what should be: CLOADM"", −1000 you would type instead: CLOADM"", 65536−1000. This is just one of those bugs in the Microsoft Basic.

A skip in time saves . . . ?

TIMER=0: SkipF "Program": Print Timer/50. This would seem to provide a means of timing a program on a SAVE routine, but the value printed seems to indicate that the Timer stops while "SkipF" is taking place.

If this is so, surely the Timer will stop while any other operation takes place and therefore will never return an accurate value?

However, "Timer=0: For DL=1 to 100: Next: Print Timer/50" returns a value about one tenth of "Timer=0: For DL=1 to 1000: Next: Print Timer/50". What, therefore, are the limitations of Timer?

P Crooke
Honeybank
Brittens Hill
Paulton
Bristol

THE TIMER function can be used to accurately time any operation. It does not stop for normal basic commands, only those which use the cassette, such as CLOAD and CSAVE. This is necessary as interrupts must be disabled when reading or writing to cassette because of the critical timings involved.

As the timer function is updated by the interrupt routine, the value will not change during cassette operations. The same applies to disk reading and writing, but is less noticeable because of the speed of a disk drive. These are the only limitations of the Timer function.

Don't press the reset button

IS IT possible for me to make my Dragon crash on pressing the reset button? Also, is there any way in which I can use variables instead of program names when loading machine code from a Dragondos disk drive? I have tried the following routine, but so far have been unsuccessful:

10 INPUT A\$
20 LOAD A\$ ".BIN"

Richard Stevens
Heathercombe
Rosemary Avenue
Newton Abbot
Devon

IT IS possible to make the Dragon freeze up when Reset is pressed. The only way out is to turn off and on again, so use these pokes with care, as you cannot regain the program in RAM. To make the Dragon freeze up on reset include these pokes in your program: POKE 114, &HAC : POKE 115, &H0F.

On your second point, it is possible to use variable names as dragondos filenames by using the "+" sign, your program should read:

10 INPUT A\$
20 LOAD A\$+".BIN"

Unplug your DOS cartridge

WITH THE reduction in prices of the Dragon disk drives, many more users now have access to a disk system. Sooner or later you realise that some games will not work with the DOS cartridge installed when loaded from tape as both the game and the DOS want to use the same RAM. The only option seems to be to unplug the cartridge. Doing this frequently will put the edge connector under a lot of stress and could damage the cartridge or your Dragon.

In the November issue of *Dragon User* I mentioned that it is possible to unplug the DOS cartridge using software. In response to the letters from Philip Ellis, Adam Caole, R Ruxton and many others here is such a program. Type the program in and save it on disk as, for example: SAVE "DETACH".

When you want to "unplug" the DOS, type RUN "DETACH" and press reset when requested. The program copies the basic cold start procedure from ROM and modifies it to ignore the DOS cartridge. To get the DOS back, just type POKE 113,0 and press reset.

The program should effectively detach any dos or similar cartridge, including Dragondos, Delta Dos, Ultra Drive Dos, etc.

```
10 ' DOS SOFTWARE DETACH V.1.1
20 CLS 1:PCLEAR 4
30 POKE 1541,2
40 FOR I=0 TO 146:POKE 3073+I,PEEK(46010+I):NEXT
50 POKE 3072,18
60 POKE 3197,0
70 FOR I=1 TO 3:READ S,F:FOR J=S TO F:READ A$
80 POKE 3072+J,VAL("&H"+A$)
90 NEXT J,I
100 DATA 148,156,8E,0C,9C,BD,90,E5,7E,83,71,157,180
110 DATA 44,4F,53,20,44,45,54,41,43,48,20,28,43,29,20,31,
39,38,35,20,44,52,41,47,4F,4E,20,55,53,45,52,00
120 DATA 13,17,8E,7F,FE,20,0E
130 POKE 114,12:POKE 115,0
140 PRINT@224,STRING$(32,140);
150 PRINT@256,"  PRESS RESET TO DETACH D.O.S."
160 PRINT@288,STRING$(32,131);
170 SCREEN 0,1
180 GOTO 180
```

Classified

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ADVERTISERS INDEX

Competition Corner

Answers to Competition Corner, *Dragon User*, 12-13 Little Newport Street, London WC2H 7PP.

Reach out for the sky

*Microdeal provides the prize to **Gordon Lee's** computation competition*

IT HAS BEEN said that there are more ways of arranging the order of a pack of playing cards than there are atoms in the known universe. If this mind-blowing, though totally useless, fact grips your imagination then in all probability you are one of the rare breed of 'abstract numerologists'. On the other hand, if it makes your head swim, then you are definitely not a suitable candidate to explore the dizzy heights of number doodling.

While on the subject of large numbers and playing cards, did you know that the odds of dealing a perfect Bridge hand — ie one in which each player receives a complete suit — is only once in 2,235,197,406,895,366,368,301,560,000 deals? Put another way, if the entire population of the earth sat down in Bridge fours and did nothing but deal hands at the rate of one a minute, it would take over three million, million, million years for such a hand to occur. Another odd fact would come to light if the entire world's population were to stand along the equator. Even if we were to assume that the equator ran entirely over land, it would only allow a space of one third of an inch for each person. However, if we were to allow a space of one square yard each, the population would cover one thousand five hundred square miles — an area about the size of the county of Suffolk.

How many times have we heard it said that someone is 'worth their weight in gold'? Taken literally, with gold costing $302 an ounce, an average individual weighing eleven and a half stone would be worth over three quarters of a million dollars. Moreover, as gold is the most ductile of all metals, this amount could be drawn out into a fine wire over one hundred thousand miles long! Consider for a moment one million pounds. Although in £50 notes it would fit into a suitcase, if it were paid in penny pieces it would have a stacked height of 89 miles and a total weight of 350 tons. Also, if these coins were laid out in a straight row they would stretch 1240 miles — about the direct distance from Glasgow to Rome!

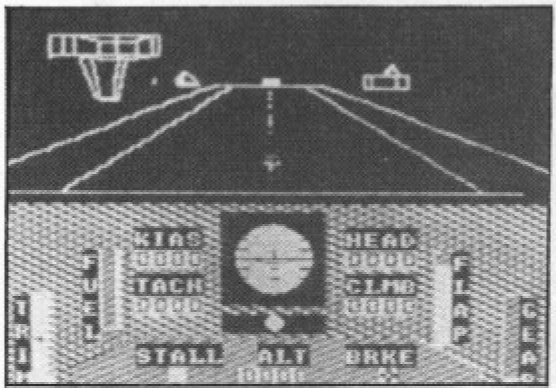
When in Rome . . .

On the subject of Rome, have you heard the joke about the ancient Roman who kept missing the bus because he thought that 11.11 was two minutes past two? Apart from being totally impractical for even basic arithmetic, the Roman number system has no letter for zero. Other curiosities include the longest date so far on the calendar which was 1888 with the thirteen-letter MDCCCLXXXVIII, and the fact that watchmakers tend to use IIII for '4' on clock faces rather than the correct number IV. Another odd 'clock' statistic is that the minute hand of Big Ben has travelled over 18,000 miles since 1859.

To work out that last figure you would need to know the length of the hand (14ft), and the value of pi (3.14159...). If you wanted to be really accurate, pi has now been calculated to over eight million decimal places. Other large numbers include the largest prime number found so far, $2^{132049}-1$, which has 39,751 digits. From this can also be calculated the highest 'perfect' number so far discovered, $2^{132048} * (2^{132049}-1)$, a number with 79,502 digits! A perfect number is one whose whole number divisors, including 1 but excluding itself, add up to that number. The two smallest perfect numbers are 6 (1+2+3) and 28 (1+2+4+7+14). After this comes 496, 8128, 33550336, and 8589869056.

Record breaking

Where large numbers are concerned, the science of astronomy has some real record-breakers, so much so that they are often difficult to imagine. However, if we could reduce the earth to the size of a grapefruit we would find the following curious facts: The moon would have a diameter of one inch and would orbit at a distance of nine and a half feet. The sun would have a diameter of 36 feet and be three quarters of a mile away, while Pluto, the outermost planet, would be at a distance of twenty-nine miles. On the Same scale, Proxima Centauri, the sun's nearest neighbouring star (actual distance 4.3 light years) would have to be placed on the surface of the moon!



This would seem a good point at which to break away from this review of totally useless facts, all of which can be easily calculated by computer. At the beginning it was stated that there were more ways of arranging the order of a pack of cards than there are atoms in the known universe. **This month's competition is to compute this *exact* number.** It is quite easy using logarithms to find an approximation, but we require the number *precisely*. (Hint: the number you are after is 52! — i.e.52 * 51 * 50 * 49 * . . . etc.)

Prize

MICRODEAL IS offering 15 readers the chance to win *Worlds of Flight*, its exhilarating new flight simulator for the Dragon.

December winners

THE FOUR cards were the nine of clubs, the ace of diamonds, the five of hearts and the five of spades. Bertram Byte is 99 years old (100 next birthday). The 10 winners, who will each receive one of Beau Jolly's 'valuepacks', are: A. Hickish of Dunbarton, Cyril Slip of Bristol, Alan Kennedy of Lisburn, C. Jones of Llanelli, Jason Emery of Emsworth, S. Hutchinson of Chorley, M. Stonton of Towcester, David Faulkner of Pontypridd, R. Gosling of Bristol and Mark Heaps of Lincoln.

Rules

TO WIN a copy of the game you must both show the answer to the competition and how to solve it with the use of a Basic program developed on your Dragon. Please do not send in a cassette containing the answer. As a tie-breaker complete the following sentence in 15 words or less: "I would like to fly because . . ."

Your entry must arrive at *Dragon User* by the last working day of March. The winners and the solution to the puzzle will be published in our June issue. Entries will not be acknowledged and we cannot enter into correspondence on the result.

RETURN OF THE RING

THE RING OF DARKNESS PART II

At last the saga continues . . .

The Guardian of Shedir is defeated, the Hell spawned hordes of the Evil Sage lie at bay. Now Ringbearer, wielder of the Four Bright Rings, must face the greatest challenge: to return the Ring Of Darkness to its creators on the hidden planet Ringworld . . . And somewhere at the ends of time the forces of evil are preparing their revenge.

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May luck travel your path.

Please note: RETURN OF THE RING is a complete adventure. You need not buy THE RING OF DARKNESS to play it.

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